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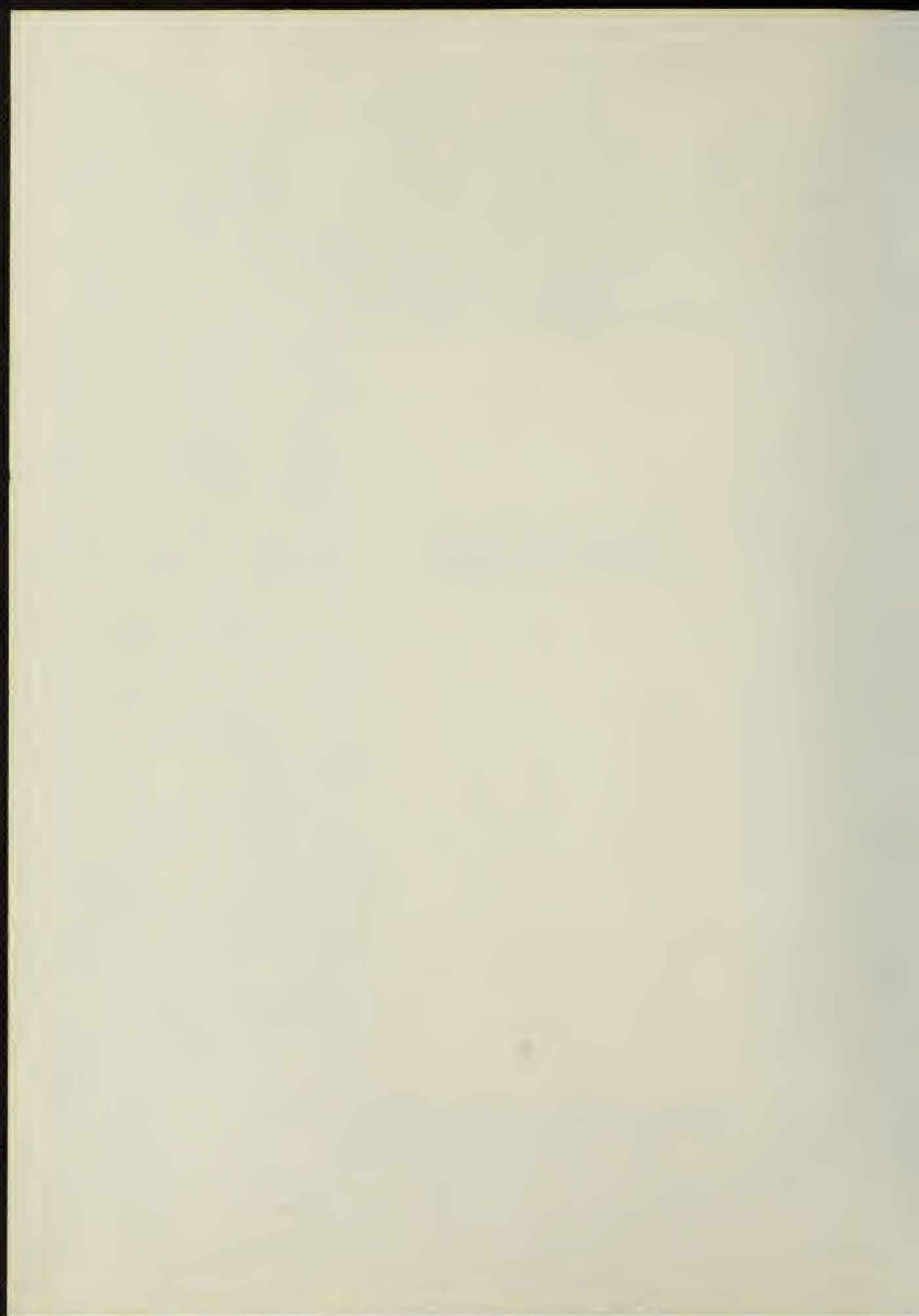
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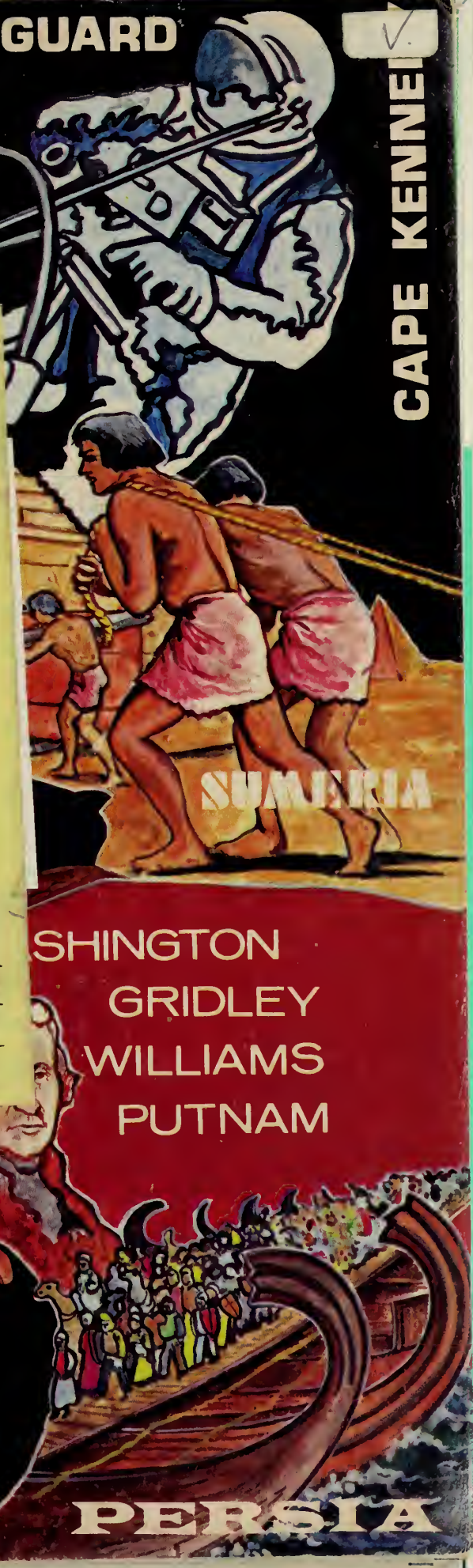
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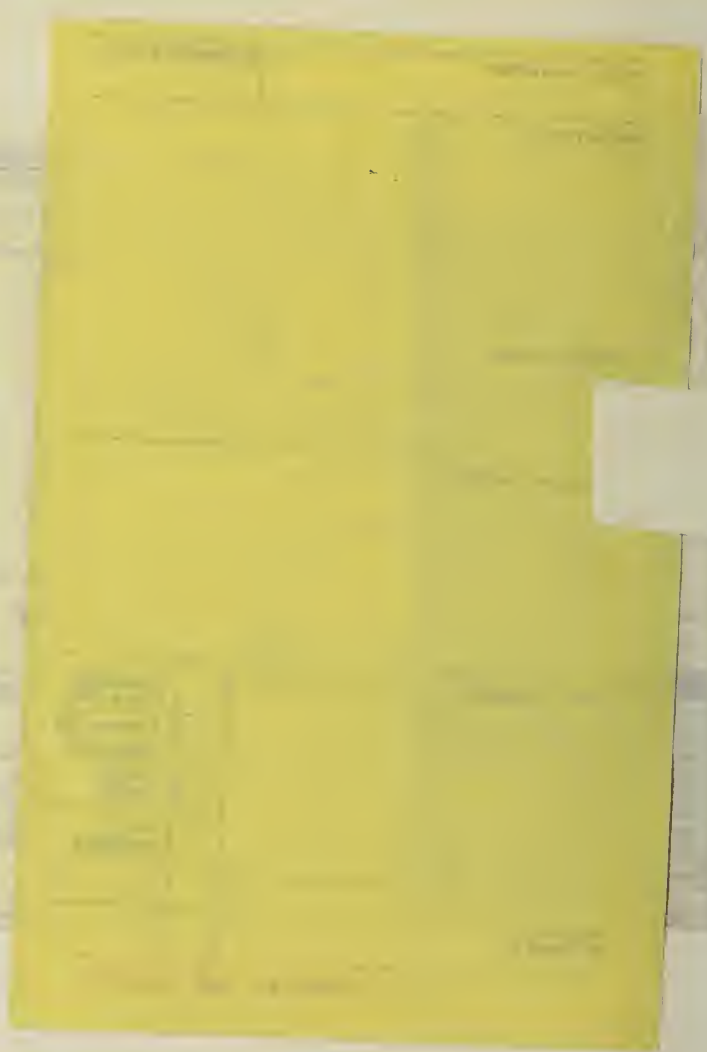
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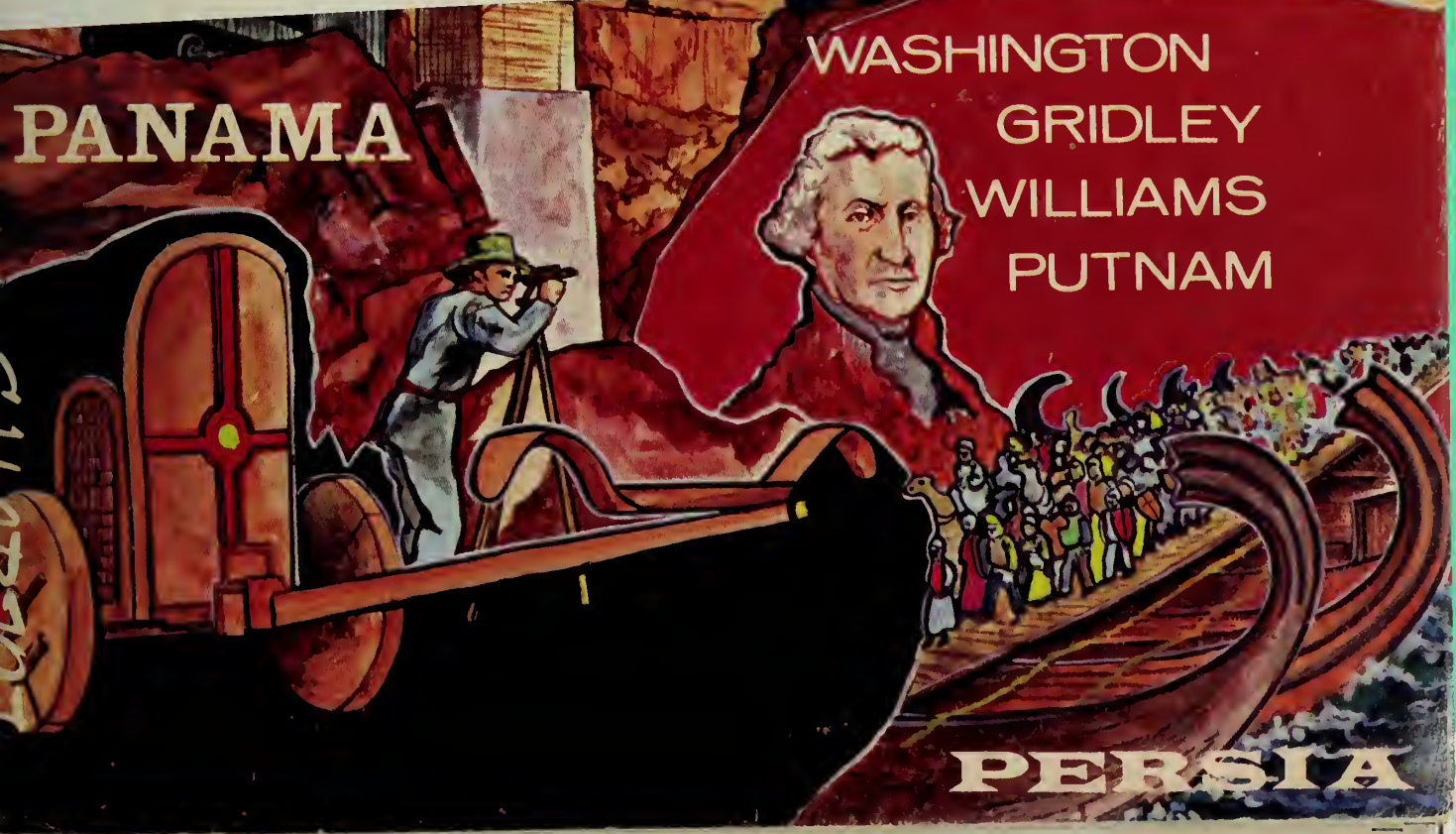
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the engineer

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SPRING 1973

VOLUME 3

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CHIEF'S BRIEFS.....

One of the two initial graduates of the Military Academy at West Point—Class of 1802—was appointed as the Army's seventh Chief Engineer on July 31, 1812 with rank of colonel, concurrently being designated as Superintendent of the Military Academy. He was but 28 years of age at the time.

Colonel Joseph Gardner Swift was born on September 31, 1783 at Nantucket, Massachusetts, and subsequently was appointed a cadet by President Adams. Following graduation in 1802, he served with the Engineers in a variety of assignments, for this was a period when President Jefferson's great dream of expanding the nation to the Pacific was nearing reality. From 1804 until 1812 he worked chiefly on the construction of Atlantic Coast fortifications.

In April, 1813, Colonel Swift reported to the Commandant of the department having jurisdiction over New York Harbor, and by a special order of the President took command of Staten Island with a brigade composed of two infantry regiments. He assumed this command in addition to his duties as Chief Engineer and Superintendent of the Military Academy. At that time, Swift was personally supervising the fortification of New York Harbor.

Later that year he became Chief Engineer of General Wilkinson's Army on the St. Lawrence where, on 11 November 1813, he distinguished himself at the Battle of Chrysler's Field. After completing the defensive works of New York, for which he was brevetted, he was voted "Benefactor of the City" by the corporation in 1814.

Following the war, General Swift assisted in the preparation of a new system of infantry tactics and rebuilding the burned capitol at Washington. He also reorganized the academic staff and planned new buildings at West Point.

Swift resigned from the Army on November 12, 1818, and became the Civilian Surveyor for the Port of New York. In 1823, he founded the first New York Philharmonic Society, and during these years served as Chief Engineer for various railroads. He is credited with laying the first "T" rails. From 1829 to 1845 he was the Superintendent of the Great Lakes Harbor Improvements.

General Swift died on July 23, 1865 at Geneva, New York. 

ENGINEERING LIBRARY



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The Engineer is an authorized quarterly publication of the U.S. Army Engineer School. It is published to provide factual and in-depth information of interest to all Engineer units. Articles, photographs and art work of general interest may be submitted for consideration to: Editor, The Engineer, USA Engineer School, Fort Belvoir, Virginia 22060. Views and opinions expressed herein are not necessarily those of the Department of the Army. Use of funds for printing of this publication has been provided by Headquarters, Department of the Army, July 11, 1969.

Subscriptions to THE ENGINEER magazine are available through the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Annual rates are 2.50 for mailing to a domestic or APO address and \$3.25 for mailing to a foreign address. Individual copies of the magazine are \$1.00 each. Checks should be made payable to the Superintendent of Documents.

ABOUT THE COVER

Art Director John W. Savage, Jr., paints a panorama of engineer heritage. This work of art vividly points up random highlights of engineering accomplishments that are further detailed beginning on page 8.

Pipeline

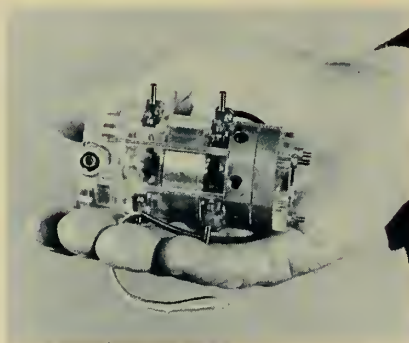
NEW CRYOGENIC REFRIGERATOR TESTED BY MERDC

The U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Virginia, has successfully tested a new cryogenic refrigerator featuring a miniature turbine-alternator no larger than a pair of flashlight batteries.

Successfully tested to 58 degrees Kelvin, or minus 355 degrees Fahrenheit, this new cryogenic refrigerator is the forerunner of a larger unit being developed with the capabilities of temperatures of five degrees Kelvin or 450 degrees Fahrenheit. The refrigerator is being developed to provide reliable cooling of superconductors in electric power equipment. While at low temperature superconductors can carry very large electric currents without the Joule heating which is a major problem in power machinery. For some high power applications the cryogenic approach results in overall size reduction compared to conventionally cooled electric machinery.

The refrigerator unit consists of a compact heat exchanger, a compressor, and the miniature turbine-alternator which features helium gas bearings. These bearings permit the turbine-alternator's 18-gram rotor to spin at 180,000 rpm at cryogenic temperatures. The

bearings also promise long turbine life since they have no rubbing parts during operation.



HISTORY SERIES TELL ABOUT WWII CONSTRUCTION

From barracks buildings to the atomic bomb facilities, the story of military construction in World War II is told for the first time in the Corps of Engineers: Construction in the United States, the 71st volume in the "United States Army in World War II" history series.

In World War II the Army Corps of Engineers superintended the largest construction program in the nation's history, providing the home base for an Army that grew to more than 8-million men and women.

A vast homefront construction effort by the Army was the bedrock for mobilization and combat in World War II.

Started by the Quartermaster Corps and carried to completion by

the Army Corps of Engineers, this building program embraced more than 27,000 projects and cost \$15.3-billion, roughly \$59-billion in 1970 prices.

Among its major features were camps and cantonments to house 5.3-million troops; plants to mass-produce explosives, ammunition, tanks, and planes; hospitals providing nearly half a million beds; a huge network of ports and depots; improvements to principal waterways and flood protection for vital industries; bomber bases which entailed a whole new technology; the mammoth pentagon building; and facilities for the epochal Manhattan project.

Corps management told all personnel: Reduce to bare essentials. Substitute! Improvise! Comb the country for materials! Get the job done with the means at hand. Military engineers knew the language well. One of them said: "The very basis of military engineering is the ability to make out with the means available." Construction was the first major industry to attain large-scale defense and war production in World War II.

Other aspects of the domestic contribution of the Army Engineers in the war have been covered in the first volume of a subseries to be published: Troops and Equipment, and a second told the story of the Engineer effort overseas in the war

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Engineering

against Japan.

A final volume still in preparation will relate the activities of engineers in the Mediterranean area and Europe in the war against Italy and Germany.

NOVEL IDEA COULD MAKE MINEFIELDS SAFE FOR TROOPS

Formed-in-place plastic "stepping stones" soon may be used to provide a safe path through minefields.

The "stepping stones," or pads, are formed by foamed plastic sprayed on the ground ahead of an operator carrying a portable backpack unit.

The special plastic forms and hardens almost instantly to cover an area larger than a mine. This distributes the pressure exerted by the footfall and lowers it below the mine's actuation point to allow the operator to cross the minefield safely as he sprays the path ahead.

The portable pack, which weighs 60 pounds, carries enough plastic to create 30 to 35 "stones." This is enough to provide a safe path through a minefield 100 feet long. The polyurethane foam "stones" are 17 inches in diameter and four inches thick.

The experimental minefield bridging concept was developed by the U. S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Virginia.

416TH SLATES NEW MAINTENANCE FOR CAMP McCOY

Despite having units of three reserve engineer battalions taking their ATT's and performing other normal training functions, five battalions under the 416th Engineer Command of Chicago, Ill., will perform over \$300-thousand of pre-planned maintenance at Camp McCoy, Wisconsin this year.

This maintenance will include repairs to bridges and roads; training sites including tank ranges; and renovation of several wooden buildings.

Over 50,000 tons of rock will be blasted and crushed for roads and parklots while 4,000 tons of asphalt will be placed over existing parking lots and sidewalks. During the two past years annual training periods, reserve engineers of the 416th have developed a recreation site named Squaw Lake Recreation Area.

It is an area where reservists may bring outdoor camping vehicles and equipment so that their families may spend their ATT's with them.

This area will continue to be improved because this year a 200 foot earth dam will be constructed as well as a swimming beach to make it more attractive for family recreation.

CHINESE TUNNEL PUT TO GOOD USE IN SOUTH KOREA

They call it the Chinese tunnel. And that is as good a name as any because the Chinese have used the 13-foot mountain opening along the Chorwon Valley route between Camp Casey and Unchon.

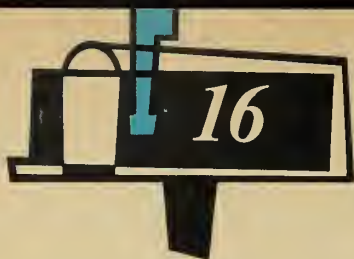
But so have the North Koreans, the South Koreans, the Americans, and most of the United Nations forces that fought in the area during the Korean War. The Japanese used it, too, right after they built it.

For the occupying Japanese, it was either a matter of up the mountain or 200 feet down the river bank to a river which was a flooded torrent during the monsoon—or straight through the rock.

So, 12 months and much chiseling later—Banzai! A tunnel. That was 41 years ago. Since then the tunnel has seen a lot of use.

Route 3 to Unchon is a Sunday afternoon breeze for those who like it. It is bumpy. It is paved and it is Route 3 that takes you through the tunnel.

The crude excavation is no engineering marvel—too short to be ventilated and too isolated for lights. But the courier making his appointed rounds can be grateful for a torturous grind avoided—Chinese Tunnel, Japanese, or whatever you tag it. Maybe the U. S. Army Engineers will find a way to improve it.



STOP-16

A FRIEND INDEED

Sir/I have been quite impressed by the quality of your professional magazine as a forum for new ideas. I make a point to read **the engineer** thoroughly for the perspective and insight it provides to an infantryman advising a Reserve Engineer Construction Battalion.

JOHN G. WILCOX

MAJOR, IN

UNIT ADVISOR

244TH ENGR BN

ROCKY MOUNTAIN ARSENAL

DENVER, COLORADO

ESSAYSONS, PRESS ON AND SO ON

I congratulate Captain George W. Gipe for his fine contributions to the Winter 1973 issue of **the engineer**. However, with tongue in cheek, I suggest the following:

The pictures of Captain Gipe on pages 6 and 7 indicate that he is being worked too hard and that he is not getting enough vigorous physical training and perhaps, due to the job tensions, he is eating too much.

I was taught that the Engineer motto was derived from French, not Latin. Indeed Webster's Unabridged Dictionary indicates that 'essay' and 'assay' (both of which mean to put to test or to try) are derived from the French 'essayer' and the Old French 'essay.' I also

thought that our Corps was patterned by and after the French who helped us in our first fight for freedom. Perhaps we should give our basic course students a few more minutes on the Corps' history, buttons and motto.

'Essayons;' 'Press On;' 'Keep Pushing;' persistence and determination alone are omnipotent!

J. M. KILGOUR

LTC, CE

WE APOLOGIZE

Sir/I would be grateful if you would make known to your readers my dissatisfaction with the way in which you represented the "British view of camouflage" in your Winter 1973 issue. When your staff member discussed the subject with me, I stipulated that I should have to approve the wording used in the article and I was subsequently shown a draft, which I approved. I am surprised to find that the final published article bore absolutely no similarity to the draft I had seen. There were 23 sentences in the final article and not one of these appeared in the same form in the draft submitted to me for approval. In fact, only one sentence was even recognizable.

It should be made clear to all your readers that the published article does not reflect the views of my Ar-

my, nor of myself, particularly with regard to United States Army policies. As for all the nonsense about "bumper stickers," "the politics of international alliances," "wasting time," and "playing with camouflage," I can only suggest that these ideas reflect a journalistic view of military affairs for which I for one do not share. The power of the printed word, taken out of context, to twist meaning is well known, but the putting of words into one's mouth, even by innuendo, is quite another matter.

R. B. HILL

MAJOR, RE

Major Hill/In reference to the article 'Four Other Faces of Camouflage' in which your thoughts on the British version of that subject appeared, the engineer staff can only say that it made a mistake. It is and has been the clear intent of this publication to 'tell it like it is.' We try not to take anyone with expertise in these technical fields out of context. As this article was not intended to be questions and answers in the strict sense, the writer was able to have some journalistic license. This, of course, in the journalistic trade is called interpretative reporting—his interpretation of your thinking on the subject. In this case, I was led to believe that your views on camouflage had been cleared by you. Obviously, such was not the case. Now that the record is straight, please accept our apology. It will not happen again. the editor

U. S. ARMY REORGANIZATION

ENGINEERING BONANZA



The most far-reaching reorganization of the U. S. Army since 1962 has considerably strengthened the role of the military engineer in the structure of the Senior Service.

A move by the U. S. Army last January to streamline its command structure for the first time in 11 years with a reorganization responsible primarily of elements within the Continental United States resulted in some major and pointed changes for the Corps of Engineers.

The changes chiefly involve CONUS elements that are responsible for the readiness of deployable units; the operation of the training establishment; the development of concepts, techniques, and materiel for land combat and logistics support.

Basically, the reorganization redistributes responsibilities, rationalizes existing missions, and concentrates on the more efficient production of the basic outputs of the CONUS base-trained personnel and units, effective weapons and equipment, and modern techniques and organizations for employment.

The reorganization also was designed to improve readiness training, the materiel and equipment acquisition process, the quality and responsiveness of management, and better support for the soldier in an era of limited personnel and a shrinking budget. The reorganization will be implemented in phases throughout this calendar year.

Under the reorganization, the Continental Army Command, the Combat Developments Command, and the Third United States Army, were eliminated; the Forces Command (FORSCOM), a single field headquarters to supervise the unit training and combat readiness of all Army units within the United States to include the Army Reserve and National Guard, has been created; the Training and Doctrine Command (TRADOC), a single field headquarters to direct all individual training, education and development of organizations, materiel requirements and doctrine, has been created; and the Army Materiel Command (AMC) continues its mission of providing materiel and

support services for the U.S. Army.

The most significant impact of the Army reshuffle on the Corps structure is in the reestablishment of a Staff Engineer in the grade of O-6 (colonel) and a section with a strength of between 70 and 80 military and civilian personnel at each of the two new commands—FORSCOM and TRADOC. Under this program, the Staff Engineer will report directly to the commanding generals of the two commands on engineer matters. This means that this is the first time since the reorganization of the Army in 1962 the Corps has been represented by a Staff Engineer in a major field headquarters in the Continental United States. Before 1962, CONARC had a Staff Engineer. The 1962 reorganization resulted in engineer functions being fragmented among the general staff elements of CONARC.

The return to the concept of having a staff engineer as a special staff officer at a major field headquarters in the Continental United States is in concert with the current organizational programs that exist in U. S. Army, Europe; U. S. Army, Pacific; the Eighth United States Army, Korea, and other major commands.

Under the new reorganization, the Staff Engineers will be the principal advisors to the commanding generals of both FORSCOM and TRADOC on engineering matters. They have staff responsibility for supervision of engineer functions throughout the command; developing concepts, plans and policies for engineer support, and providing for integrating and coordinating engineer matters by assisting other members of the staffs of the two commands in actions that have engineer implications.

Other key moves under the reorganization that will affect the engineers are—

- The Combat Developments Command Engineer Agency becomes part of the Engineer School and comes under the guidance of the Deputy Commandant for Combat and Training Development.

- The 62B Mechanics Course relocates from Fort Belvoir, Virginia, to Fort Leonard Wood, Missouri.

- The Chemical Corps functions are being consolidated and, under this action, doctrine, training, materiel requirements, and organizational responsibilities for smoke and flame operations are being transferred to the Corps of Engineers.

- The Mobility Equipment Command in St. Louis is being converted into the Troop Support Command, and dedicated primarily to improving the personal equipment and environment of the individual soldier. Initially, Natick Laboratories and other personnel equipment related activities will be assigned to this command. Later, responsibilities for materiel handling equipment, construction equipment, and industrial engineering will be transferred to the Tank Automotive Command in Detroit, Michigan.

The new Forces Command is moving into the old Third Army facilities at Fort McPherson, Georgia. Its mission is straight-forward—combat readiness. The FORSCOM will command all operational divisions and STRAF units in the Continental United States. Troops under FORSCOM—about 225,000 active Army and 660,000 in Reserve units—will represent about 60 percent of the total Army strength. About 37,000 civilians also will be employed by the FORSCOM.

Although active installations under FORSCOM will report directly to FORSCOM headquarters, the commander, FORSCOM will use three Continental U. S. Armies (CONUSA) headquarters—First U. S. Army at Fort Meade, Maryland, Fifth U. S. Army at Fort Sam Houston, Texas, and the Sixth U. S. Army at The Presidio of San Francisco—to help him command and supervise the Reserve components. These Army headquarters will command the Army Reserve units assigned to their control and supervise the training and readiness of the Army National Guard in their areas.

Since the mission has been tightened for the CONUSA, the size of the headquarters has been reduced considerably. Through the reduction in the size of the CONUSA's, personnel resources will be freed for use in establishing nine Army Readiness Regions (AAR) to serve as extensions of the CONUSA and to provide dynamic, on-the-spot assistance to the Reserve components.

The AARs are small, active Army elements with functional specialist and branch assistance teams and selected unit advisors. Most battalion-level advisors are being withdrawn from single Reserve unit dedication and placed into support teams to capitalize on their branch and functional expertise.

There will be few major structural changes in the Reserves, but several training brigades of the Army Reserve training divisions will be converted to maneuver training commands to increase the current Maneuver Area Commands' capability to help units in

their planning and execution of command post exercises, field training exercises, and Army training tests.

Thus, the management of Army readiness has been improved by—

- Dedicating a single command to its readiness functions for active and Reserve components.

- Removing a command element between the Department of the Army and the major active Army forces.

- Dedicating the CONUSA and their regional extensions to the readiness of the Reserve components.

The other new command, Training and Doctrine Command, is being headquartered at Fort Monroe, Virginia. It will manage all individual schooling and training, the development of combat organizations, better ways to use them, and the Army Reserve Officer Training Corps program.

The TRADOC will have a strength of about 180,000 military or 22 percent of the active strength of the active Army force. The new command also will employ about 49,000 civilians. TRADOC will merge the previously separated CDC agencies with the service schools. This removes the organizational barrier between the experience found in service school faculties and student bodies and the organization charged with distilling that experience into new combat development products such as doctrinal literature, TOEs and equipment requirements.

As a result, military education will be improved and the opportunity for fresh input to the combat development process will increase. With basic and individual training and the service schools all under the same command as the combat developments process, a closed loop between teaching and doctrinal development will emerge.

The service schools will be responsible for the analysis and development of the basic organizational building blocks of the Army, the Tables of Organization and Equipment, through the brigade level. They will produce field manuals and publications, and develop and examine proposals for new equipment and support requirements.

To provide a mid-management assist to the Commander, TRADOC in coordinating the combat developments effort, three new functional centers will be created. These functional centers will be the Army-wide focal points for the design and development of doctrine, organization, materiel requirements and functional systems. They will use the building blocks developed by the schools and develop organizational and support concepts through the corps level.

The Combined Arms Center will be located at Fort Leavenworth, Kansas, the Logistics Center at Fort Lee, Virginia, and the Administration and Personnel

Center at Fort Benjamin Harrison, Indiana. These centers also will be charged with the responsibility for curriculum and instructional consistency of the schools in their functional areas to insure early integration of doctrine into service school instruction.

As a change to the current system, TRADOC will manage the Army ROTC program through four regional activities, each commanded by a brigadier general. These ROTC regional activities will be located at the sites of the ROTC summer camps—Fort Bragg, North Carolina; Fort Riley, Kansas; Fort Knox, Kentucky; and Fort Lewis, Washington. In recognition of the ROTC as the source of 65 percent of its second lieutenants, the Army has placed great emphasis on insuring the continuation of a viable training program.

Thus, the management of individual training and combat developments will be improved by—

- Combining the responsibility for the production of creative combat developments outputs with the training and education functions of the service schools whose instructors and students teach, learn, and maintain a continuous enriching dialogue about organization, techniques of employment and materiel requirements.

- Providing dedicated management of Reserve Officer Training Corps.

With the creation of FORSCOM and TRADOC, the role of the installation commander has been increased in importance. In both of these new major commands, the installation commander will have a direct line to the major command without intervening headquarters layers.

In the new organizational concept, the installation commander has both training and readiness responsibilities to both FORSCOM and TRADOC for units of those headquarters assigned to his post. In carrying out these responsibilities, he optimizes the resources provided by both commands. Assignment as either a FORSCOM or TRADOC post is governed by the size of the largest activity on the post.

The new organizational changes also recognize the prominence of the installation commanders in area support activity on a geographical basis. This means that area boundaries based on population density, state or regional boundaries have been drawn to give the installation commanders increased area support functions for Reserve component, ROTC, public information or other functions.

There are other ways where the installation commander will benefit from certain aspects of the current reorganization not involving FORSCOM or TRADOC. For example, the reorganization of club management at Department of the Army will allow the installation commander to call on a DA agency spe-

cializing in this function for technical assistance while retaining command of the clubs and messes on his post.

The end result is that the installation commander becomes the dominant figure in the accomplishment of FORSCOM and TRADOC missions, and is the central figure in the accomplishment of Army policies on a geographical area basis.

The key action involving the Army support structure is the organization realignment of the Army Materiel Command. It will continue as the Army's major command concerned with the design, development, procurement, distribution, and support of modern, reliable combat and support materiel for U. S. forces. The organizational changes within AMC will improve its capability to do this. Actions include—

- The Armaments Command at Rock Island, Illinois, will pull together activities now widely dispersed at Dover, New Jersey; Joliet, Illinois; Edgewood, Maryland; and Rock Island into one command. This action consolidates the Munitions Command and the Weapons Command—the guns and bullets people.

- The consolidation at Fort Monmouth, New Jersey, of the splintered Electronics Command, presently headquartered at both Philadelphia and Fort Monmouth, will clear up the management problems caused by the geographical separation of several important functions.

- The Army Depot System will be realigned to reflect managerial improvements and reduction of the workload. Overhead and support functions at the depots will be consolidated, and specialization and concentration of depot maintenance and supply assignments will occur.

Department of the Army headquarters, as well as its major commands in the Continental United States, also is affected by the reorganization. Most importantly, DA will reduce its involvement in the day-to-day operations of the major commands and restrict itself to planning and integrating broad programs, developing policies, arranging priorities, allocating resources, pulling together the activities of TRADOC, FORSCOM, and AMC, insuring controls for tasking new missions, and providing for disciplined association of resources with new missions.

It is anticipated that this reorganization will permit a significant shift of personnel from headquarters and logistics support functions to combat and combat support activities.

While the current Army structure proved to be excellent in support of the war in Vietnam, the streamlining will enable the new organization to refocus and more easily handle its normal peacetime war-deterrent role. **E**

ENGINEER HERITAGE

Lieutenant Colonel Clifford C. Lussier, Jr.

With the constantly accelerating pace of technology and the ever-rapid tempo of military operations, today's military engineer has little opportunity to become acquainted with the rich heritage that history has endowed his profession. The feats and accomplishments of renowned military engineers of the past, not only advanced military arts, but also laid the foundation for and gave the impetus to all later engineering disciples.

The birth of civilization, now recognized as occurring independently in several widespread areas of the world, has been characterized by advances in arts and crafts, urbanization, religion, specification, and, regrettably, warfare. From its earliest days, the art and science of engineering has been tied intimately to the waging of wars. As prehistoric villages grew in size and wealth, protection from marauding tribes became necessary. To answer this problem, walls surrounding entire cities were constructed.

These are among the earliest significant engineered structures that have survived to this day.

Archaeologists generally agree that between battles, the ancient soldier spent his time at constructive pursuits—building history's first structures. Recent evidence suggests that military men of ancient Sumeria who first drained the marshes of the lower Euphrates and constructed dams, dikes, and a network of canals were responsible for completing man's first irrigation system. Although all early civilizations have been characterized by warfare, the ancient Assyrians emphasized this aspect more than others.

The Assyrians are credited with the invention of the first wheeled vehicle, the war chariot, with which they conquered the entire Near East as well as Egypt. The battering ram, scaling ladders, siege towers, and ponton bridges were among other developments of the Assyrians, and it was during the reign of Tiglathpileser-I in the 11th century B. C. that military engineering as a distinct discipline was born. Fortifications such as walls and defensive towers were emphasized, but these early soldiers also planned and laid out parks and plantations for the use of the citizens; shrines and temples were also among their early achievements.

This engineering versatility, both in military and civil works, continued during the dominance of the Persian empire in the 5th century B. C.

Although more famous for her philosophers, artists, and theological scientists, Greece also provided us with several military engineers of renown.

Dinocrates, master architect, planner, and builder of the historic city of Alexandria, was the field engineer to Alexander the Great.

The earliest evidence of the use of engineering specifications results from the work of Philon, another military engineer of the 4th century B. C.

His written outline of the general dimensions, wall thicknesses, and window sizes of a naval arsenal at Piraeus is the equivalent of four pages of today's specifications. The great mathematician and inventor Archimedes, put his considerable talents to use as military engineer for his native city, Syracuse, where in 214

B. C. he constructed numerous ingenious devices for the defense of that city against Marcellus. His efforts enabled the city to stave off the superior Roman force for over two years.

Just as Alexander's army spread Greek culture from Europe and the Mediterranean to Africa and India, so too, Roman legions subsequently carried Imperial civilization to the far corners of the then known world.

The importance of rapid communication was quickly recognized by these early empires, and road networks were originally constructed for the primary purpose of moving legions from one frontier to the other.

From the writings of Vitruvius, one of the most famous engineers of the era, we know that schooling in military and civil engineering subjects was required in the training of the well-rounded engineer of the day. Pliny the Elder, better known for his monumental 37-volume "Natural History," was a naval engineer of some repute, arising to the command of the vast Roman naval base at Misenum in the Bay of Naples, where he perished in the calamitous eruption of Mount Vesuvius in 79 A. D. To these and other great Roman engineers, we owe our gratitude for the invention of pozzuolana-type cement, used extensively in structures of this age.

Meanwhile, Roman field engineers accompanied Caesar's legions, building structures throughout the empire, many of which remain to this day as testimonials to their talent and ingenuity.

Caesar's famous bridge over the Rhine near what is now Bonn, was a historic achievement of the military engineer, Mamurra. Without power or machinery, he supervised the construction of a 1,300-foot, pile bent, timber bridge that was completed in less than 10 days. Many of us can commiserate with Mamurra, for only 18 days later, he was directed to destroy his bridge for tactical reasons.

It was shortly after this period that the precursor to the term "engineer" was first used. In 200 A. D. Tertullian, Latin historian and writer, referred to an early military siege device, a battering ram, as an "ingenium," an invention or product of ingenuity.

The word "engin" came into use in later years applying strictly to engines of war, and the "ingeniator" was one who devised, built, and operated these devices.

During the Dark ages, the two most noteworthy developments in engineering structures were the fortified castle and the Gothic cathedral.

At first this may seem incongruous, yet during this period, most educated men were churchmen, and the

employment of ecclesiastics as military engineers was not uncommon. Perhaps the most famous of these was Gundulfus, Bishop of Rochester and military engineer to William Rufus. Gundulfus, not only reconstructed the cathedral of St. Andrew in Rochester, adding bastions as part of the city's defenses, but also, in 1078, constructed the White Tower, the magnificent inner keel of the Tower of London.

The Domesday Survey in 1086 lists one "Waldivus ingeniator" as owner of nine baronial mansions, undoubtedly compensation for services as chief engineer to William the Conqueror.

Ailnoth, another early military engineer, was the chief surveyor of Westminster and builder of Windsor Castle in 1174. It was also in England at this time that the official in charge of the maintenance of works of defense and the operation of engines of war was entitled "attilator," a term then synonymous with engineer and most probably the origin of "artillery."

The Renaissance witnessed the rapid development of military engineering as a distinct profession. The invention of the cannon quickly made the feudal castle obsolete, and new techniques of fortification and siegecraft were developed. Italian military engineers were in the vanguard of the innovators. Valturius is credited with authoring the first printed engineering book, "De Re Militare", in 1473, and Francesco de Marchi (1504-1577) was one of several to devise and publish works on fortified bastions. His contemporary, Niccolo Tartaglia, authored treatises on fortification and gunnery, and although his calculations were later proved inaccurate, his new techniques earned for him the title, "Father of Ballistics." The beginnings of canal building in Europe has also been attributed to the Italian military engineers. Thirteenth century Milan was the site of the first large canal, reputedly an extension of a castle moat; and an engineer of that period invented the hydraulic lock, a most significant step in the history of transportation.

Bridges building was not neglected by fortification engineers of the day. The famous Ponte Vecchio, spanning the Arno at Florence, Italy, was originally a bridge fortress, and is still noted for the daring flatness of its arches and the slenderness of its piers.

Perhaps the greatest military engineer of any age more noted as a scientist, painter, sculptor, and thinker, was Leonardo da Vinci. Creator of the Mona Lisa (La Gioconda), da Vinci began service as military engineer for Ludovico, Duke of Milan, in 1483, a relationship that was to last for 16 years. Some excerpts from his famous resume to the Duke displayed his wide knowl-

edge of field engineering: "I can construct bridges, very light and strong capable of easy transportation, and with them pursue or on occasion flee from the enemy . . . I have means by tunnels and secret and tortuous passages . . . to reach certain and designated points . . ." for the purpose of mining. "I will make covered wagons secure and indestructable, which, entering with their artillery among the enemy, will break up the largest body of armed men." Leonardo also served for two years as military engineer to the infamous Caesar Borgia, during which time he devised and constructed a mobile siege tower for the assault on Ceri in 1503. His voluminous drawings and notes reveal many catapults, armored vehicles, and flying machines; and they also contain one of the earliest detailed sketches of a truss bridge. These reflect an extraordinary, fertile and inventive, mechanical mind that anticipated many later developments.

Military engineering continued its advancement in England through the Feudal ages. The notorious Henry VIII, being extremely fearful of invasion, lent special emphasis to the development of coastal defenses. In 1513, he appointed a "Master Trenchmaster" who later became the "Master of the Ordnance," responsible for all defensive fortifications.

In 1747, the king's engineers initiated a military survey of Scotland which became the foundation for the Ordnance Survey. This activity remains under the control of Royal Engineer officers to this day.

Then British military engineers pioneered in the development of large masonry dams in the 19th century. In India, Colonel Sir Arthur Thomas Cotton and Colonel Sir Proby Thomas Cautley undertook monumental irrigation projects. On the Ganges and Indus Rivers, and in the Madras area, Poona, Bhatgarh, Tnasa, and Peryar dams rapidly set successive height and length records during the last 20 years of the century.

Their efforts in creating a modern version of an ancient art helped India lead the world in irrigated acreage of the time. Royal engineers continued their predominance in the big dam field with the construction of the original Aswan dam on the Nile in 1902.

Meanwhile, in the 17th and 18th centuries, France went forward to become the outstanding nation of Europe and leader in the development of modern military engineering. This was the age that gave us Sebastian Le Pretre Vauban, who must be included among the greatest engineers of all time, military or civil.

He began his military career in 1651 at the age of 17 and in five years had become "engineer-in-ordinary" to Louis XIV. For 55 years he was involved in study-

ing, planning, and directing the construction of fortifications, and his unfailing siege techniques gained for him the title of "the man who captures cities." Voltaire, not noted for his compliments, called him "First of engineers and first of citizens."

Among Le Pretre Vauban's many feats of construction was the fortified harbor at Dunkirk, still of interest to all harbor engineers. But his greatest contribution to the engineering profession was his proposal in 1672 that the engineers of the army should become an organized special branch of the service. The corps' Imperiale du Genie, history's first organized engineering body, was to carry engineering in France to new levels of achievements.

Promoted to Marshal of France in 1703, Vauban shortly thereafter began a study of abuses in the administration of the king's tax. He was impressed with the plight of the peasants and disturbed at the burden of their taxes and the exemptions of the upper classes. His work, published in 1707, remarkably foreshadowed the principles of the French Revolution and was promptly banned by order of the king.

Heartbroken, Vauban died a few days after publi-





cation of the order. In 1702, a member of the Corps du Genie, Alain M. Mallet, in addition to writing a famous book on fortifications (*Le Travaux de Mars*, 1671), first combined a telescopic sight with a level bubble to produce the form of instrument we know as a dumpy level.

Another great French military engineer was Charles-Augustin de Coulomb, usually recalled for his electrical experiments. His engineering works may still be seen in the outstanding fortress of Martinique.

Coulomb received special recognition in 1776 for his resolution of the classical problem of the resistance of a beam, and he laid the foundation for the common theory of flexure still used in the design of beams and girders.

Military engineers have had a significant role in both military and civil functions of the United States government since its founding. Washington's experience with engineers during the revolution led him, as President, to establish an engineer school at West Point in 1795.

Then under Jefferson, the present Corps of Engineers and the U. S. Military Academy at West Point were

established in 1802. Until the Civil War, West Point was part of the Engineer Department, and for many years it was the sole source of academically trained engineers in the country.

The Academy's impact during one of the nation's most critical growth periods (1820-1870) cannot be understated. West Point graduates actively taught in fledgling scientific institutions, compiling technical texts for use in other schools as well. This influence may be seen dramatically from an inspection of the roll of West Point's first 65 years. Among graduates of this period were 26 college or university presidents, 23 principles of academies of other schools, and 85 professors and teachers.

During the same period, military engineers were playing a vital role in the exploration and mapping of our expanding country. The planning and the surveying of internal improvements such as roads, canals, railroads, and river and harbor works were also among their early projects. These engineering activities implemented the work of the War Department and other federal agencies and materially aided the growth of state and private enterprises.

The list of great U. S. Military engineers is too long for inclusion here, but their accomplishment in the fields of science and engineering will live as testimonial to their greatness. The Washington Monument, the Panama Canal, the great Pacific railroad surveys, the myriad river and harbor and flood control works, and the Manhattan project, where our nation entered the atomic age, were all managed and directed by military engineers. Yet the tasks are not complete.

Our predecessors have but laid the foundation on which we must continue to build. As military engineers, we have unique capabilities to respond to emergencies, whether they be war or in peace, and we must continually look to the future. Lessons of yesterday should help pave tomorrow's road; reflections on the achievements of our predecessors hopefully will inspire even greater accomplishments in years to come. 

Lieutenant Colonel Clifford C. Lussier, Jr., is presently assigned to the Armor and Engineer Board at Fort Knox, Kentucky. He holds a Bachelor's Degree in Management and Economics and is a graduate of the Engineer Officer Candidate School and the Officer Advanced Course at Fort Belvoir, Virginia. The colonel has served with engineer construction battalions in CONUS, Europe, and on group staffs during two tours in the Republic of Vietnam.

APPRENTICE TRAINING FOR ENGINEER SOLDIERS

UNION RECOGNITION

Colonel W. R. Hylander, Jr.

and

Major Kenneth D. Jobe

What is "union recognition"? Why should it be of interest to you?

If you are an engineer soldier with construction experience, it is a plan to help you document your skill, so it will bring a better job and higher pay when you return to civilian life.

If you are an engineer leader, it means some of your men will be seeking to upgrade their skills through on-the-job training and cross-training. They also will want you to certify their training and experience in their "log books".

If you are a recruiter—and this includes a lot of engineer leaders these days, particularly in the Reserves and National Guard—you now have an added incentive to offer the young man you are trying to enlist or to re-up for another hitch.

At this point, we ask you to read the letter in the box on the opposite page. That letter promises the recognition we are talking about. The Associated General Contractors of America, Inc. (AGC) have provided a similar letter acknowledging their chapters and branches will recognize and give consideration to the experience reflected in the "log book."

To win the benefits of this recognition, however, the Army has to do its part. This article describes how the Army's part affects you, as well as how union recognition got started, where it now stands, and where it is headed.

As the US Army began to think about the challenge of recruiting an all-volunteer force, The Engineer School started to look into union recognition. We talked to the British, who have had a similar program for more than a decade. Brigadier S. E. M. Goodall, OBE, MC, Commandant of the Royal School of Military Engineering at Chatham, told us: "Within the British Army, only the Royal Engineers consistently meet their recruiting objectives, and only because of their trade union apprenticeship program." A statement like that was enough to set us to work in earnest. Our plan was to pick out one engineer skill; to win

recognition from that union and to start a pilot program; then to expand into other skills and into an Official Army-wide program.

After comparing all engineer enlisted MOSs with related civilian job classifications and union affiliations, we selected MOS 62B, Engineer Equipment Repairman, for the pilot effort. It matches very closely the civilian trade of Heavy Duty Repairman, affiliated with the International Union of Operating Engineers (IUOE). It had the added advantage of being taught at Fort Belvoir. Informal discussions at Department of the Army and Department of Defense level and with the US Department of Labor disclosed that no one else was doing anything along the lines of union recognition, and also that none would object to our development of a pilot program. So we called the IUOE; we met and talked, and we learned about some problems.

The first problem was local autonomy. Unlike Great Britain, local U. S. unions have wide latitude in accepting new members. The national or international headquarters publish standards for apprenticeship, but it's up to the local how the standards are applied. The IUOE cannot, as an example, guarantee that every ex-serviceman who meets its standard for Heavy Duty Repairman will be automatically accepted into any local in the country. It is fact of life that we have to live with, but it is not insurmountable.

The second problem was the lack of a military work record meaningful to a union or to a contractor. A discharge certificate will only show that the Army called this man an "Engineer Equipment Repairman" and perhaps that he finished some course in it at a place named United States Army Engineer School. Did he change oil and fix flats, or did he rebuild transmissions? Did he really work at it for two and one-half years, or did he spend much of his time pulling guard or playing on the football team? Apprentices in a union-sponsored apprenticeship program must compile a record of thousands of hours of training and ex-



THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC.

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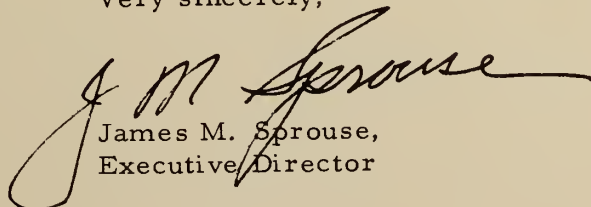
January 4, 1973

TO: All Soldiers in Construction

You are receiving valuable training and work experience as heavy construction equipment operators and as repairman. The skills that you are acquiring in the service can lead to a satisfying and well-paying career in the construction industry after you are discharged.

A completed and properly authenticated log book of your training and your work in the Corps of Engineers will provide a record of your ability if you should decide to work in construction after you leave the Service. All Chapters and Branches of the Associated General Contractors of America and the Joint Apprenticeship Committees with which they are affiliated will recognize and give consideration to your log book and the experience it reflects should you decide to enter our industry after you have completed your service in the United States Army.

Very sincerely,


James M. Sprouse,
Executive Director

AMERICA PROGRESSES THROUGH CONSTRUCTION *Construct by Contract*

perience, all certified by a card-carrying union member. So we designed a soldier's log book, which we call an Apprentice Master Record. It contains sheets for recording his training and work history, with each sheet to be certified by the soldier's supervisor. This log book appeared to solve this problem, but it led right away into the next one.

"I was in the Army, too, and I've seen M1 pencils used on rifle targets. How can you keep guys from faking their records" No doubt about it—this union man had a good point. So the idea of a Central Registry was born. Quarterly, the soldier will summarize his hours worked, get it certified by his supervisor, and mail it to the Engineer School. There it will be maintained in a computerized Central Registry, and made available on request in order to verify the soldier's log book totals.

One last hurdle remained. IUOE apprenticeship standards and guidelines are governed by a National Joint Apprenticeship Training Committee, made up of contractor and union representatives. Their approval of the Engineer School's union recognition program was required. In November 1972 the USAES program was presented to them at the IUOE's annual meeting in New Orleans, and approval was obtained. This approval, as can be seen from the letter in the box with the article, covers all operating engineer skills and not just Engineer Equipment Repairman—so we were one step further down the road toward union recognition.

We've deliberately dwelled at some length on how the program got started, because it is important for engineer leaders and soldiers to understand why individual log books are needed, and why they need to be accurate and true. One phony log book can tarnish the future of everybody involved in the program.

Here is how the program will work. Starting this spring, trainees in 62B and other operating engineer courses (see list in box) will get an orientation on union recognition and be invited to apply for enrollment. Individuals already holding one of these MOSs are also invited to enroll; a letter is going out to unit commanders worldwide. Active Army and Reserve Components, giving details on how to do it. If you somehow miss getting the word, just write to the Secretary, US Army Engineer School, Fort Belvoir, VA 22060.

Those who are enrolled will receive a log book—the Apprentice Master Record. Each participant enters his hours worked and his training received, and weekly he gets a supervisor to sign the log for verification. Quarterly he sends a certified summary to The Engineer School. That's all there is to it. When the participant leaves the service, he has his log book as a

record of his skill, and The Engineer School will confirm it on request from its Central Registry.

The log book is an unofficial, individual record. It is not a part of a soldier's 201 file. He keeps it—not the unit. The unit's only responsibility is to verify the soldier's entries. If he loses it, he's lost the master record; the USAES computer will be able to produce only his quarterly totals. He—and not the Army—is the loser. It's up to us, and to you as his leader, to insure that he understands this.

Old timers that we've talked to, including noncommissioned officers and some warrant officers, have expressed the wish that such a program had been available when they started up the ladder years ago. We are sorry, too, that it wasn't, but at least they can pick it up now if they choose. We invite them to enroll also, and do document their past training and experience by affidavits from former commanders or associates. By way of encouragement, however, we can offer the advice that unions and industry are interested in getting experienced men, and that a military retiree in his forties isn't old by civilian standards. A good documented work history will help get you a job, but if you are good you can get a job anyway. Once you're on the job, it's your performance that counts.

We regret, too, that union recognition is not yet available outside the operating engineer skills listed in the box with this article. For carpenters, electricians, printers, and others, this involves negotiations and we will let you know via **the engineer** magazine and via letters from the Engineer School as soon as we can.

For those in Reserve and National Guard units, there is no reason why you cannot combine the hours spent at your skill in the military service with those on your civilian job. Get a log book from USAES and record your military training and experience, and add it to that you are building up on your job.

Now you should be aware where all this is headed. It is more than just another recruiting gimmick, and more than just another fringe benefit for the man who is leaving the service. Since the days of World War II, the Army's individual training plans have been designed primarily for rapid mobilization of a draftee Army. "Teach him the minimum he needs to survive and to perform, and ship him overseas. Let his future commander worry about the rest." Rather quickly, the Army's training environment and its training philosophy are changing. We need to attract and to retain career soldiers. In the Corps of Engineers, we need to have a highly skilled base of construction skills, active and reserve, able to undertake limited wartime and peacetime missions as well as the job of mobilizing a

conscription Army for all-out general war. We need to train mechanics to become future maintenance supervisors, and grader operators who can run any piece of equipment on the job. Over the years, the construction trade unions and civilian construction industry have developed an apprenticeship training system that accomplishes essentially the same goals: progressive career development for the individual, and a capability for the industry to expand rapidly when the need arises. It is worth some study.

Apprenticeship programs vary widely, but all involve several things:

- A period of indentured, probationary service.
- Training, under skilled supervision.
- Experience, demonstrated and documented.
- Standards, recognized and applied.

Civilian apprenticeship programs receive public recognition by being registered with a State apprenticeship agency, or with the Bureau of Apprenticeship and Training, U.S. Department of Labor. Graduates get a certificate that make them journeymen; the certificates are issued by the Department of Labor.

If the Army registered its training program with the Department of Labor, and it was accepted as meeting national apprenticeship standards, *the Army could certify its own journeymen*. We would not need to depend on a local union's or contractor's decision as to how much credit to grant for military service. Informal discussions with labor officials indicate that this is entirely possible. So our union recognition effort at The Engineer School is taking a new tack—aimed at registration of military training as a formal apprenticeship program.

It appears that the Apprentice Master Record will take care of documenting a soldier's experience. He becomes indentured when he enlists, so that's no

problem. What does appear a problem, however, is establishing training and experience requirements that approximate industry-wide standards. For operating engineer skills, these are three-four years of experience and about 144 hours of training per year. We have done some preliminary study here at The Engineer School, again for 62B Engineer Equipment Repairman, and it appears that a military apprenticeship program should look like this:

After finishing basic training, apprentices would take the 62B20 course at Fort Leonard Wood, Missouri. This nine-week course (360 hours) prepares him to perform organizational maintenance and repairs. He would then serve in a unit for about two and one-half years, compiling perhaps 4,000 hours of log-book time. If he then is considered to be qualified, he would return to Fort Leonard Wood for the advanced level 62B30 course. This is also a nine-week course. After another year of work at the 30 skill level, he would get his journeyman's certificate. Hopefully, he would be interested in staying on in the service and would re-enlist. Even if he chose to get out, the Army would have benefited from having a better motivated and better skilled mechanic for four years.

For most other skills, an advanced training course would not be essential. OJT in the unit may be adequate.

There is a related program you should also know about. The Army, Navy, Air Force, and Marine Corps are actively engaged in studying the consolidation of common training. An Interservice Training Review workshop was held at Fort Leonard Wood in February 1973, to identify common areas in training for construction skills. For the equipment operator and engineer mechanic skills, we found commonality by fall-

IUOE CLASSIFICATION	ARMY MOS	MOS TITLES
Universal Equipment Operator	62F	Crane Operator
Grading and Paving Operator	62E	Crawler Tractor Operator
	62K	Grader Operator
	62L	Wheeled Tractor Operator
	62M	RT Forklift & Loader Operator
Plant Equipment Operator	62D	Asphalt Equipment Operator
	62G	Quarryman
	62H	Concrete Paving Equipment Operator



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International Union of Operating Engineers

★ 1125 SEVENTEENTH STREET NORTHWEST ★ WASHINGTON, D. C. 20036

★ AFFILIATED WITH THE AMERICAN FEDERATION OF LABOR AND CONGRESS OF INDUSTRIAL ORGANIZATIONS
★

★ OFFICE OF GENERAL PRESIDENT • DISTRICT 7-8560
★

17 DISTRICT 17

December 14, 1972

To All Operating Engineers in Uniform

I wish to take this opportunity to welcome you into the trade of Operating Engineer. Now that you have acquired some skill as an Operating Engineer in the Corps of Engineers, I would like to encourage you to build on this skill to enhance your service career and to assist you in getting a better job when you return to civilian life.

Although you can expect to be tested whenever you apply for membership or for acceptance into an Apprenticeship Program in the Operating Engineers, this log book, when completed and signed, is evidence of all your training and work experience in the service and will be recognized as such by our locals. I urge you to keep this record up to date and look forward to working with you on your return to civilian life.

Sincerely,

Hunter P. Wharton
General President

ing back upon the civilian requirements for these skills—the apprenticeship standards we've just been discussing. Workshop findings were reviewed at an Interservice Training Review meeting at Pensacola, Florida in March, and The Engineer School is being tasked to develop a core curriculum for each of the basic operator skills. They are going to be designed to apprenticeship standards, and we believe the Army Engineers will lead the way in putting them into practice.

In summary, union recognition is a reality for operating engineer skills, and participation is welcomed. See your commander, or write to The Engineer School. Similar recognition for other engineer skills is coming soon. And, further on, but within sight, is the prospect for the Army to be able to certify its own journeymen.

We'll keep you informed as it develops. In the meanwhile, The Engineer School invites your participation and your comments. Send us your applications for enrollment in this pilot program, and send us your thoughts about where we are headed.

Back during World War II, Bill Mauldin said it all with his cartoons of an infantryman telling an engineer: "Yer lucky. Yer learnin' a trade." We think you engineers are lucky, too, and we're gaining for

you some of that recognition. 

Colonel Walter R. Hylander, Jr., Deputy Commandant for Combat and Training Development, at the Engineer School, has had tours with the 1st, 2nd, 3rd, 138th, and 288th Engineer Combat Battalions; the 487th Aviation Engineer Battalion (USAR), and at the Republic of Vietnam Armed Forces Engineer School. He holds a master's degree in Civil Engineering from M.I.T., and is a registered professional engineer in New York and a Fellow, American Society of Civil Engineers.

Major Kenneth D. Jobe is Chief of the Individual Training Branch, Training Programs Division, Department of Doctrine and Training Development at the Engineer School. He has served with various Construction and Maintenance units both in the Continental United States and overseas and with the Engineer Branch, Office of Personnel Operations, DA. The major is a registered professional engineer in the Commonwealth of Virginia. He holds a BS in Geology, a BS in Civil Engineering, and is a graduate of the Engineer Officer Advanced Course and the Command and General Staff College.

PIN PULLER

A simple solution has been suggested and accepted to an old problem that faces anyone attempting to extract a stuck ponton connection pin from light tactical rafts (LTR). The solution is an easily fabricated sliding hammer pin puller made from readily available components. If a unit is faced with this problem, the unit shop or support section should fabricate one or more of these pin pullers.

The bill of materials consists of the following items—

- 1 ponton connecting pin.
- 1 railroad track maul head (10 lb).
(a similar 10 lb head from other hammers can be substituted)
- 2 Sections of five links of 0.375 inch chain.
- One foot and one six inch section of 0.5 inch diameter mild steel hot or cold rolled rod (cold rolled preferable).

The pin puller is easily fabricated—

Weld a 0.25 inch or heavier fillet bead on the rod end of the pin head for reinforcement. Weld the short

0.5 inch rod perpendicular to the top of the pin head. Weld the other 0.5 inch rod perpendicular to the end of the first rod forming a T; slide hammer head onto the pin. Cut the end of the pin off at top of the taper. Weld two links of one chain to the end of the pin. Turn the pin 180 degrees and weld two links of the other section of the chain to the pin being careful that the free links of chain extend equally beyond the pin end.

Removal of stuck pins requires two men to get the job done.

Attach the chains of the puller to the horns on the pin to be pulled. One man holds the tool in line with the pin and a second man grabs the hammer head and slams it up against the puller head. A few blows in this manner and the most stubborn pin is easily removed.

This information will be included in the next revision to TM 5-210, Military Floating Bridge Equipment. 

HOW LANCASTER, PA. GOT

No one in this Pennsylvania Dutch community thought twice when it started to rain during the middle of June, 1972. The people of Lancaster, Pennsylvania, along with their Amish and Mennonite neighbors, continued their lives as usual and watched as the nourishing water fell from the heavens. No one realized that this rain would continue for days resulting in the worst natural disaster in the history of the East Coast. Tropical Storm Agnes had demonstrated her might and left behind a torn and wrecked community.

Lancaster is a medium sized city located about 70 miles east of Philadelphia. It is the capital of a county with the same name and was once the capital of the United States for one day in 1777. It has one major stream, the Conestoga Creek, that flows from north to south passing through the east side of the city.

During the early morning hours of June 21, 1972, the single day that most of the damage occurred in this

area, the rising and rampaging waters of the Conestoga Creek "washed-out" a span of the Engleside Bridge. This bridge is south of Lancaster on the city's major southern artery, United States Route 222. The traffic volume of this route is estimated by the Pennsylvania Department of Transportation as being 5,000 vehicles per day. This number increases considerably during the summer because of the large number of tourists that visit the Pennsylvania Farm Museum which recalls the 19th-century life down on the farm.

A Corps of Engineers Area Office of the Baltimore Engineer District was established for this flood-damaged area on June 26, 1972 to provide relief of the havoc caused by Tropical Storm Agnes. Personnel for this office consisted of Army Engineer officers and Corps civilians assigned on temporary duty from locations throughout the United States. Representatives from this office conducted a reconnaissance of the Engleside Bridge on the first day of operations and immediately commenced removal of the damaged portion of the bridge from the stream bed to eliminate the possibility of further damming of the creek.

The Baltimore Engineer District, after coordination with the Pennsylvania Department of Transportation, directed on July 1, 1972 that a Bailey Bridge be in-



ITS BAILEY

Captain George C. Richardson

stalled at the Engleside site to restore the vital Route 222. The parts required for the bridge were released by the Army Materiel Command in St. Louis, Missouri, and shipment commenced on July 1, 1972 from the New Cumberland Army Depot located about 20 miles north of Lancaster. All bridge parts were at the site by July 3, 1972 allowing construction to start the next day.

After the receipt of the order to install a Bailey Bridge, the Engineer Area Office requested that project proposals be submitted by three General Contracting Firms in the immediate vicinity. The low bidder was the J. M. Brenner Company from Lancaster and a contract was awarded on July 2, 1972. Since the contractor had no prior experience with the Bailey Bridge, a bridge specialist from the 902nd Float Bridge Company of Fort Belvoir, Virginia, and 14 construction engineers from the 76th Engineer Battalion of Fort Meade, Maryland, were obtained to provide technical assistance for the duration of the project.

The bridge installed consisted of a 180 foot long Triple-Double Bailey Bridge. Construction started on July 4, 1972 and completion was realized on July 6, 1972. The bridge was inspected and accepted by the Pennsylvania Department of Transportation the fol-

lowing day. They limited the capacity of the bridge to five tons because of the problems of controlling the heavy trucks which normally use Route 222. Truck drivers have a tendency to disregard bridge classifications and this particular Bailey Bridge will not carry a truck heavier than 16 tons.

Cooperation between the U. S. Army, state and city governments, and the contractor and his crew was exceptional making this operation very successful. The damaged bridge was replaced in a relatively short period of time causing the least amount of inconvenience to the people of Lancaster City. The bridge is expected to be used for about two years until it is replaced by a permanent structure.

If you should ever be in the Lancaster area, you will be amused by the horse-drawn buggies carrying the Amish men with their bonneted womenfolk at their side crossing a tactical military bridge in a modern American city. 

Captain George C. Richardson is a recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia. He was recently presented the Henry Larcom Abbot Award for excellence in writing based on his presentation of "How Lancaster, Pa. Got Its Bailey."



the essayons button



Distinctive in design, long in existence and exclusively identified with the U. S. Army Corps of Engineers, THE ESSAYONS BUTTON reflects long-standing pride in the military engineering profession, despite some conjecture as to the origination of the heraldic devices embodied on its surface.

First definitely known to have been worn during the War of 1812, the button has been a mark of distinction to Army engineers since its adoption. Two former Chiefs of Engineers generally are credited with its inception, although some mystery remains as to which of them designed the insignia.

Colonel Jonathan Williams, the sixth Chief of Engineers and the first Superintendent of the U. S. Military Academy at West Point, and Major General Alexander Macomb, the ninth Chief of Engineers, are considered to be the most likely designers of THE ESSAYON BUTTON.

History records that while serving as Superintendent of the U. S. Military Academy in 1807, Colonel Williams began to plan and construct fortifications in New York Harbor to preclude possible invasion by any of the great powers then engaged in the Napoleonic struggle in Europe.

Macomb, then a captain serving under Colonel Williams, rendered a map of the harbor at the latter's direction. That rendition carries Macomb's name as delineator. It is interesting to note that the legend and signature section of the map contains the surmounting Eagle, the Water Bastion, the Rising Sun with Rays, and the motto "Essayons"—all of which are reflected in the THE ESSAYONS BUTTON design.

The Macomb rendition included a round fort to the right with flag on top, which is believed to represent the "stone tower" then under construction—now known

as "Castle Williams." Also reflected in the map was a frigate entering the space between the two protecting fortifications.

A prima facie case might thus well be made that young Captain Macomb was the enterprising American Engineer officer who symbolized the work of the Corps on-going at that time.

Yet, it could have been his Chief, Colonel Williams, who furnished the idea for the decorative effect containing the principal elements of the design on the button, and that Macomb was directed to apply the Colonel's own ideas in decorating the 1807 map. Such a conclusion is a logical one, for it is known that soon after becoming Chief Engineer and Superintendent of the Academy, Colonel Williams was permitted a free hand in designing his own special uniform for the officers of the new Corps of Engineers. This he did. It is quite conceivable that he may have designed the button for that uniform before 1807, and whether Macomb merely used a Williams design for an already existing ESSAYONS BUTTON to decorate his map of 1807 is open to question. Existence of this map provided an earlier date, however, than the War of 1812 for the actual use of the design now found on the button.

The year 1814 was selected as the date the button was first known to be used because the button was actually seen on a uniform at that time by an identified individual. General George D. Ramsey, writing about his cadet experiences at the Point during 1814-1820, stated: "Captain Partridge (Acting Superintendent from 1808-1817) was never known to be without uniform . . . His was that of the Corps of Engineers with the embroidered collar and cuffs and the ESSAYON BUTTON. . . ." e

ENGINEER VIEW OF THE C-5 GALAXY

Lieutenant Colonel Hector Wood
Major Ronald L. Lane

The introduction of the C-5 aircraft into the Military Airlift Command (MAC) fleet has vastly increased the deployment capability of the United States Armed Forces, particularly its Corps of Engineers. Logistics concepts of engineer planners in the past have depended upon surface movements to meet the bulk of even emergency transportation requirements. Now economical air movement of outsize items of engineer equipment and massive volumes of construction cargo is made possible by the giant C-5 transport.

The Army Materiel Command (AMC) conducted a test and evaluation for 22 months of the characteristics, capabilities and limitations of the C-5 aircraft in the air logistics role and its relationship to the Army logistics system. It was completed last December. Headquarters, Continental Army Command (CONARC) has also participated in a study effort to determine the impact of the C-5 system on joint air movement operations and to determine the suitability of doctrine, organization, materiel and procedures for employment of the C-5 in a joint air movement role.

Department of the Army directed both of these study efforts which are managed by the US Army C-5 Evaluation Group under operational control of the Combat Developments Command. Army participation in the C-5 evaluation effort was at the invitation of the Air Force to ensure that the Army is capable of fully utilizing the increased airlift capability of the C-5 system. The AMC and CONARC efforts have already modified old or developed new deployment policies and procedures and air logistics concepts. Final results should present an Army awareness of MAC airlift capabilities never before achieved by the green suiters.

What does the C-5 aircraft offer the Corps of Engineers? How can engineers take advantage of this giant flying machine? It's still early to predict the ultimate C-5 capability for the Corps but some completed tests and actual C-5 missions flown indicate tremendous possibilities for engineer missions worldwide.

Consider its size. In Corps parlance, the C-5 is BIG! Its cargo compartment measures 121 feet in length, 19 feet wide, 13½ feet high, enough space for eight of Fort Belvoir's bowling alleys. Its cargo deck is longer than the Wright brothers' first flight. The cargo compartment can carry six standard Greyhound buses or

90 staff cars, or, properly parked, 128 Austin Healey Sprites—enough to eliminate half the parking problems of the Engineer School's Humphrey Hall at Fort Belvoir, Virginia, when three advance courses are in session.

Physically, the C-5 practically covers a football field: 247.8 feet long with a wing span of 222.8 feet. Its tail stands six stories up at 65.1 feet, almost twice as high as the jump towers in airborne training. Its fuel capacity of 49,000 gallons would furnish sufficient fuel to run an average car more than 60 years.

When a C-5 pilot says, "Fill'er up!" he's talking 6½ rail tankers of fuel. Each of the four 8F-39 turbofan engines, with rated thrust at 41,100 pounds each, is large enough to garage a VW. Their power and high-lift devices enable the aircraft to take off within 7,500 feet when fully loaded and land within 4,000 feet. Under rated capacity the C-5 can lift more than 60 tons from Travis to Vietnam with one refueling stop or 75 tons from Dover to England non-stop. It can airdrop 100 tons of cargo on a single pass over a drop zone.

In design, the C-5 has some notable advances of interest to engineers. Its 28-wheel-high flotation landing gear spreads the weight pressure sufficiently to allow sustained operation on unimproved airfields. The wheels can be deflated while the plane is in mid-air in anticipation of unimproved airfield landings. The C-5 can "kneel" forward, aft or both ends to truckbed height and the visor nose and aft doors when open expose the full width and height of the cargo compartment for rapid loading and off-loading. Full width ramps on both ends of the C-5 allow double row loading or unloading activities.

The C-5 provides the US Army with an aircraft capable of deploying engineer combat or construction equipment and personnel to any contingency area in the world. During tests to date, a wide range of equipment has been carried on the C-5, varying from the M151A1 jeep to a 75-ton per hour rock crushing unit. Multiple shipments of three CH-47 helicopters to Vietnam from New Cumberland Army Depot, Pennsylvania, have practically made that a routine operation. Recently, one of the engineer construction battalion's workhorses, the model 290 tractor with scraper, was successfully test loaded on a C-5 by the CONARC



These four photos give one a graphic view of the





Size and loading capacity of the giant C-5 Galaxy



Evaluation Group. Significantly, only the C-5 is capable of transporting some equipment by air.

The C-5 is predominantly used for deployment and logistics support in rear areas. If tonnage requirements justify it and the risks for this \$54 million aircraft are acceptable, the C-5 could be employed directly to forward combat areas. It is designed to operate in such areas where austere cargo handling facilities are the rule rather than the exception. In May of 1972, five M48 tanks were airlifted into the Vietnam combat zone on three C-5s in a ten-hour mission. This is putting the critically needed Army equipment at the scene of the action in a big way.

In addition to the engineer battalion's equipment, the C-5 can also transport its operators and construction or combat engineers in the upper level troop compartment. Up to 73 troops can fly in comfort in the regular upholstered, reclining airliner type seats, arriving at their destination ready to accomplish the assigned mission immediately upon landing. A galley and all the conveniences of a commercial flight are available to non-drinkers and anti-movie buffs. For emergency movement requirements, a palletized seat kit can be installed in the cargo compartment and an additional 267 passengers can be air transported. For passengers preferring unorthodox delivery, the C-5 is fully capable of paratroop drops, putting the airborne operator into the drop zone with his equipment. An airborne engineer battalion could be delivered to a remote location by C-5, execute its drop, and within a few days prepare an airstrip capable of taking C-5 landings. The event of this happening is improbable because of the extremely high value of the aircraft, but it is conceivable.

The Military Airlift Command has five air transportable loading docks (ATLD) which can be positioned in forward areas, for example newly prepared, engineer constructed airstrips, to mechanically load and unload palletized cargo directly from the aircraft. The ATLD can be extended to a 296 feet length, is 63 feet wide and has an adjustable height of from 48 to 57 inches. It has a capacity equal to three C-5 loads. The use of an ATLD in conjunction with the ability of the C-5 to operate from unpaved airfields would permit delivery of Army cargo and equipment much closer to the objective area where permanent facilities would not be available.

How will the C-5 impact upon engineer operations? Perhaps a little "crystal ball gazing" is appropriate at this point. It's a well known fact that the logistics problems associated with the deployment of an engineer unit are colossal. Troops and their equipment have seldom been deployed together, especially by air. Resupply of newly deployed troops has historically been less than adequate. To help reduce this problem vast

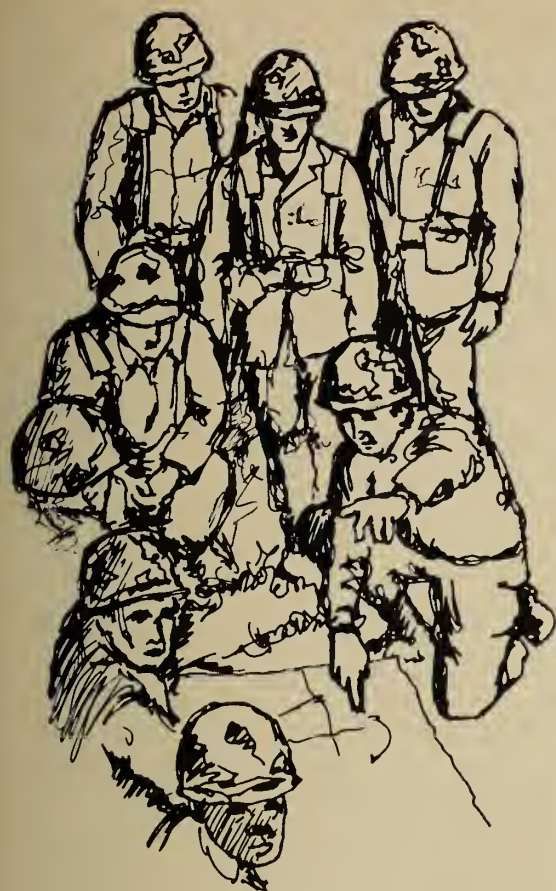
quantities of engineer equipment, repair parts and construction supplies are stockpiled in strategic contingency areas around the world. Tremendous maintenance requirements are necessary to keep this equipment and supplies ever ready for emergency use. Now, and even more so when the C-5 squadrons are filled, the Corps of Engineers has the capability to air transport engineer combat or construction battalions with their own equipment anywhere in the world they are needed. The necessity for pre-positioning equipment and supplies overseas diminishes with the delivery of each new C-5. Personnel-wise this could mean less engineers required overseas to maintain stocks.

While the Corps has always strived to insure that its battalions have excellent equipment, they must do so within the confines of a stringent budget. The ability to reduce supply inventories because of the rapid movement capability of the C-5 would allow quantity considerations to be applied to further improvements in quality of engineer equipment and supplies. The Corps of Engineers would also assist in reducing the much talked about "gold-flow" by reducing overseas stockpiles and relying more upon the C-5 for rapid deployment. The real estate rental payments, military personnel spending, local national payrolls and "mysterious disappearance" of supplies could all be reduced through reliance upon aerial delivery.

As of July 1972, 62 of the scheduled 81 C-5s had been delivered to MAC. These aircraft have had the unique obligation of satisfactory operational performance while still in a testing stage of development. Its recognition as the world's largest military cargo aircraft has maintained a public spotlight on every one of its successes and failures. Fatigue and reliability problems have accompanied the development of practically every civilian as well as military aircraft. The Air Force is severely testing the C-5 to find and fix its problems and make the C-5 perform its intended mission well. To use our Navy counterpart, the SEABEES' motto, "The C-5 Can Do." And the Corps of Engineers capabilities worldwide have been substantially increased as a result of having this cargo superbird in the MAC fleet.

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Major Ronald L. Lane is a former systems analyst of the C-5 Evaluation Branch. A veteran of the Vietnam war, he is a graduate of the U. S. Military Academy, the Engineer Officers Career Course, and has Masters Degrees in civil engineering from the University of Missouri, and business administration from George Washington University.



TRAINING TOMORROW'S LEADERS TODAY

Captain Robert R. Froude

The U. S. Army has taken a giant step forward with the establishment of the new senior level school for noncommissioned officers. The school for future Sergeants Major is a prestigious first for our NCO's. As the Army War College is for officers, this school will be the capstone of professional educational development for the "noncom."

The Sergeant Majors Academy opened its doors to 100 students (92 Active Army and eight U. S. Army Reservists and National Guardsmen) at Fort Bliss, Texas for the first time this past January. And now a Sergeant Majors Academy Selection Board has convened to select 400 students for the next class that begins July 2nd and finishes in January of 1974. There will be 384 Active Army NCO's and 16 Reservists and Nationalguardsmen in the second class.

Selection for this senior course is competitive and tough. To be eligible, "noncoms" must be in grade E-8, have between 15 and 23 years of service, and possess a current EES of 100 or better. The course is 22 weeks in duration, therefore involving a permanent

change of station. Married students are being encouraged to bring their families.

Rather than being aimed toward particular Army specialties, the senior school is purely branch immaterial and broad in scope. It covers functions and operations of various national government agencies, the other services in a joint role, and major Army headquarters and commands. And it goes without saying that there will be plenty of Engineer NCO's taking the course. the editor

The majority of yesterday's and many of today's noncommissioned officers have been placed in the untenable position of living up to a reputation that reports them as being the "backbone of the Army." And, indeed, they are that. However, in order to support this reputation the NCO has been reduced to relaying solely on the rather questionable "experience factor" or, if you will, "on-the-job training." The foundation was at best shaky in the past. But today the subtilities of modern leadership and the complexity of equipment



have completely destroyed the myth that an effective manager of people and projects can rely on experience only.

The skills of today's NCO must be updated, his methods must be refined and his approach enlightened, if he is to continue to play an effective role as the "backbone of the Army." The dynamic NCO of today must blend up-to-date concepts acquired through formal education with his time-honored experience. Tomorrow's NCO must become familiar with his trade early in his career and periodically, he must update the fundamental knowledge of his skills.

In an effort to provide the necessary formal system of education for its front line supervisors, the Department of the Army and the Continental Army Command developed the Noncommissioned Officer Education System (NCOES). Specifically, in July of 1970, the U. S. Army Engineer School instituted a pilot program—NCOES. After several changes in curriculum, the ENCOES as it exists today was implemented in February and March of 1972. (see Winter 1972 issues of the engineer) The importance of this system in the career development of the NCO and the professionalism of the Engineer Corps demands that some discussion be devoted to a consideration of the objectives of ENCOES, those for whom the course is designed, the concepts

of instruction, and finally the methods of performance testing.

Recognizing the Army's need for a more effective leadership, the Engineer School at Fort Belvoir, Virginia, has developed a program of study that seeks to—

- Enhance the leadership capabilities of the senior NCO (E-6-E-8), and to give impetus and direction to the potential leadership qualities of junior NCO's (E-4-E-5).

- Place emphasis on increasing the level of technical skill of the Engineer NCO through development in one of several major skill areas. In the case of the young soldier, a "hands on" approach toward practical training is stressed. The advanced course attempts to marry the more complex concepts of Army engineering with the senior NCO's wealth of practical experience.

- Instill in the NCO a spirit of self-confidence and motivation. The ENCOES system also provides the soldier an opportunity to plan a career path through three progressive levels of formal instruction—basic, advanced, and senior NCO training.

Each 12 week Engineer Noncommissioned Officer Basic Course (ENCOB) is made up of approximately 60 students. There were 10 classes programmed for Fiscal Year 1973. But the number of classes will be increased to 13 in Fiscal Year 1974. Students entering the course are, to a large extent, E-4's or E-5's who have demonstrated leadership potential, and who are able to meet the entrance requirements established by the school. However, of the 304 students attending the past seven basic courses 54 have been admitted directly out of Advanced Infantry Training. More than half of all students selected for ENCOB come from and return to their parent Continental United States units. Up to a maximum of 25 percent of the total student input is provided by the overseas commands. These students attend the course in conjunction with a permanent change of station move back to the Continental United States.

The Engineer Noncommissioned Officer Advanced Course accepts students in the grades of E-6 and E-7. This student input is generated by means of central selection by the Department of the Army, and is generally of equal distribution between those coming from a parent unit and returning to the same unit, and those attending the course enroute during a permanent

change of station. Three classes are being cycled through the course in Fiscal Year 1973. The classes will be increased to four in Fiscal Year 1974.

A Department of the Army Noncommissioned Officer Education System Selection Board met April 30, 1973 at the Adjutant General Personnel Center, Fort Benjamin Harrison, Indiana, to select outstanding E-6's and E-7's for attendance at the 19 Army service schools in Fiscal Year 1974. A total of 5,400 soldiers are expected to be tapped to attend the various career management courses such as ENGINEER during the next 12 months.

The student, whether basic or advanced, is the focal point of the course. All are given diagnostic tests early in the first week of the course. These tests and a screening of the individual's record cause students of like ability to be assigned to a carefully selected member of the faculty. The faculty advisor monitors the student's progress, provides council and when necessary—remedial instruction. In addition to providing evening study halls, the Engineer School has recently opened an Individual Learning Center. This center consists of video tapes and programmed texts designed to supplement and reinforce class room instruction.

Both the basic and advanced courses have a duration of 12 weeks, and are divided into four phases. Both make use of the tracking method.

Although the level of instruction differs, the course content for ENCOB Phase I and ENCOA Phase I is similar. Each course stresses basic leadership and management principles; supply, maintenance, and administrative procedures; and finally emphasis is directed toward individual development. In general these subjects are common military subjects that are essential to career development.

The common phase or Phase I which lasts just slightly over five weeks is followed by Phase II—a tracked phase. This portion of the course is devoted to the specific career areas within the Engineer Corps—Combat Engineering, Mechanical Maintenance, Construction and Utilities, and Topography.

Phase III is oriented toward increasing an individual's skill in his particular Military Occupational Specialty. Major duty areas at the 40 skill level in the basic and at the 50 skill level in the advanced course are also developed in the phase.

In the basic course, Phase IV provides the student with "hands on" training and practical exercises which provide an opportunity to demonstrate acquired skills. Through the Engineering Stakes Problem each soldier finds himself in direct competition with his peers.

Phase IV for the advanced student is an interesting



diversion. The student selects a practical work project, develops the problem, and presents a proposed solution. The exercise which lasts two to three days allows the student to apply his training to a real world problem.

The instruction in both the ENCOB and ENCOA courses is further supplemented by an elaborate electives program. The program allows the student to select two courses from a High School Electives Program, Formal College Credit Program, or a group of Military Electives.

Finally after 12 weeks of intensive study and demanding tests the graduate of the school returns to his unit with a better understanding of the Corps, of new techniques, and possessing the ability to impart these ideas to others. The young are aggressive leaders planning for the future. The seniors are experienced soldiers—tempered through instruction—ready to help others do their thing better. e

Captain Robert R. Froude is attending the Engineer Officer Advanced Course at Fort Belvoir, Virginia. He was the commanding officer of the 510th Engineer Company (MDS) in Vietnam and also served with the 79th Engineer Battalion (Construction) in Germany. The captain holds a BA in International Affairs from George Washington University.

DYNAMIC

THE DYNAMICS OF IMPRO

Major Don W. Barber

Much has been said about quote—dynamic training—unquote since the establishment of the Engineer Dynamic Training Council in 1971. Comments have ranged from commendatory to condemnatory. By and large those comments which fell in the latter category were more than likely occasioned by a lack of appreciation for just what dynamic training really is all about.

When discussing “dynamic training” we are talking essentially about imaginative training,—or better yet, training which is an improvement over previous training ways and means. The improvement results from the innovation and the ingenuity of the trainer. That is the purpose of this article—to focus on some of the more noteworthy accomplishments in the Engineer area of improved training and to highlight USAES training objectives.

Many of the training accomplishments recounted here grew out of council efforts while others derived from the initiative and imagination of staff, faculty and students at the Engineer School.

This article represents the pervasiveness of the desire at the USAES to improve engineer training. The article was assembled with the assistance of representatives from every major department at the USAES.

The Council, on behalf of the USAES, is certain that it would be beneficial to discuss some of the more progressive training achievements (read that improvements) which have occurred at the USAES since 1971. Additionally, for your plans, and hopefully your comments, the USAES wanted to give you a preview of training objectives, a training roadmap, if you will, of the direction in which the USAES is headed.

What has been accomplished in the past eighteen months? Read on—

- **Engineer Dynamic Training Survey**—This survey provided the data needed for an assessment of engineer problems plaguing engineer units and resulted in the publishing of a report which should now be in the hands of most engineer units, both Reserve Component and Active Army. The USAES sincerely hopes that this effort will precipitate training changes for the

betterment of unit and individual training. Coverage has been given to the survey findings and recommendations in earlier issues of **the engineer**.

- **Army Training Program for Non-Divisional Combat Engineer Battalion (ATP 5-35T)**—A new ATP was developed using a systems engineering approach for a non-divisional engineer combat battalion. This effort was a first of its kind for Corps of Engineer units and has since served as the principal model by CONARC for development of training programs Army-wide. Coverage was given to this new concept in an earlier issue of **the engineer**.

- **Field Feedback System**—In the past, the USAES has relied upon mailed questionnaires to graduates as the principal source of feedback to determine if we were training the tasks the engineer soldier most needed to perform his duties in TOE units. The responses to these questionnaires have often been sparse, occasionally unrepresentative, and usually provoked more questions than were or could have been answered. The goal of the newly developed Field Feedback System is to better determine what you in the field think we should be teaching or, in its broadest sense, what the training development needs of the Army's engineer soldier really are today. To accomplish this goal a Field Feedback Team has been formed and launched visits to engineer units in March 73, visiting selected units in USAREUR first with follow-on visits to Continental United States units during Calendar Year 1973. Data will be gathered by the Field Feedback Team through a combination of questionnaires and personal interviews with members of each unit. This information will then be used to develop: resident training taught in service schools and training centers; MOS tests; the basis for MODB surveys; the framework for preparation of new technical manuals and nonresident correspondence courses; the basis for new Army Training Programs (ATP's) and Army Training Tests (ATT's); Augmentation to Army Subject Schedules (soldier's tasks not taught in schools that can best be taught by unit or self training); and an

TRAINING

TRAINING AT THE USAES

outline for a "One Stop MOS Study Guide." In the final analysis, field feedback will serve as the basis for the systems engineering of all training development.

- **Expanded Reserve Component Support Program**—Reserve component engineer training support by the USAES was formalized and centralized in the Department of Non-Resident Instruction, in the summer of 1972. The program which is designed to increase the level of USAES participation in and support of reserve component engineer training is just becoming fully operational. Action under the program was taken as the program definition evolved and many units have already reaped its benefits. As formulated the program is comprised of four subprograms embracing over 20 major activities aimed at improving the quantity and more importantly the quality of engineer training for the Reserve Components. The subprograms—resident assistance, nonresident assistance, field assistance and liaison—center around the identification of a myriad of existing assets which are being and will be uniquely applied to reserve component training assistance. To date some of the more salient activities have been the institution of mobile training teams in selected subjects, the presentation of special non-POI, or more precisely tailored POI, instruction and perhaps most importantly the establishment of a clearing home for information on training resources and means within DNRI.—

- **Informal Training Literature**—A series of informal training literature was developed in concert with the Combat Arms Training Board for map reading titled "Don't Get Lost," Camouflage and Field Fortifications titled "Don't Get Hit," and Mines and Boobytraps titled "Don't Get Blown Up." These publications are written in a style oriented toward the individual soldier and should be available to field units in the near future.

- **Trade Union Recognition**—A program designed to obtain trade union recognition of Army acquired training and experience was developed for one skill. Fuller coverage is given to this effort elsewhere in this

Spring 1973 issue of **the engineer**.

- **Camouflage and Mine-Countermining Training**—New concepts for training camouflage and mine-countermining specialists were developed which, if accepted by the Army's training establishment, will ultimately lead to the reorganization of the combat engineer squads.

- **Company Commander's Preparatory Course**—A correspondence course was designed to prepare a junior officer for company command by providing specialized training in selected administrative/managerial subjects. Fuller coverage of this course will be accorded in the **engineer magazine** and Engineer Newsletter.

- **Engineer Skill Training Program (ESTP)**—A program was developed to train soldier craftsmen in hard skills through the combined application of correspondence course study and both technical and practical training with the Facility Engineer. AR 35-8, Training-Engineer Skill Training Program, has been published and distributed to further inform unit organizations and installations about this program.

- **Engineer Commander's Update Packets**—A package of selected topics was prepared for new battalion commanders. The packet includes DA policies and writings on managerial and administrative techniques, social problems, and other items of interest to a battalion commander.

- **EOAC Home Study Program**—An Active Army oriented program was developed for completing the Advance Course by correspondence. This pilot program places the officer in a permissive TDY status for three months at his home station to complete the course. CONARC approval is pending.

- **Self-Grading of Correspondence Courses**—This procedure was established for two reasons—to improve administration of correspondence courses by reducing processing time and more importantly, to offer the student a first step in self-pacing his study efforts. Under this concept correspondence course enrollees grade their own lessons, with only the final exam graded by USAES.

● **Programmed Text Format**—Virtually all texts supporting correspondence courses for both new and revised subcourses are being prepared in programmed text format. This is another step toward the full self-pacing of courses.

● **ENCOA Dynamic Training**—A special block of instruction titled "Operation Dynamic Training" was developed for training the Engineer Noncommissioned Officers Advanced Course. This practical exercise places the student in a realistic training environment, with imposed constraints of facilities, time, and other resources, in which the student is required to produce a training program using ATP 5-35T. This exercise permits the student to apply dynamic training concepts and create dynamic training situations.

● **ENCOA Special Student Task**—This unique, innovative training situation provides each ENCOA student with an interesting, challenging and individual mission assignment. Having chosen a task from a list of approximately 40 assignments or having created his own assignment, each student performs research, presents a briefing of his findings and observations, and submits a written after-action report.

● **Engineer Stakes**—This challenging, totally "hands-on" field practical exercise was designed for the Engineer Officer Basic Course (EOBC) and Engineer Non-Commissioned Officer Basic Course students. It places the student in the role of a squad or platoon leader, as appropriate, and presents the student with a series of demanding and realistic missions which must be accomplished within allotted time constraints. The student is required to act both mentally and physically to successfully complete each mission. For example, the EOBC student is required to perform such tasks as: request and adjust artillery fire; land navigate across country; and inspect and determine corrections for when he gets to his home station, to interject more in-layout of road construction stakes, minefield layout, batterboards for buildings, and demolition charges. The non-commissioned officer student is required to perform such tasks as ESC on an item of equipment, land navigate across country, assemble rigging items to lift and move a load, and other rigging tasks. The student is in direct competition with his peers and can opt to take "bonus" stakes to improve his score. The engineer stakes problems provides the student with some sound dynamic training ideas which can be used, when he gets to his home station, to interject more interest in his unit training program.

● **Orienteering**—Orienteering was introduced into the ENCOA and EOAC training programs.

● **EOAC Expedient Military Engineering Elective**—This course was designed to stimulate the imagination of and develop creativity in the Engineer Officer Ad-

vanced Course student. Creative thinking can be defined as the ability to take bits of knowledge and assimilate it into new patterns. New patterns evolve from divergent thinking. The course is based on the above premise and case studies—the case information is developed to a certain point and the student is then asked to solve the problem. No course of action is given—the ingenuity of the student is used to devise new courses of action. This elective attempts to inculcate in the student the desire to solve problems rather than merely acquiescing to the problems or accepting the first plausible answer.

● **Engineer Operations Officer Elective**—A 45 hour elective course was designed to provide EOAC students with eight seminar subjects encompassing the major functions that an Engineer Operations Officer may expect to encounter in combat or construction battalions. Students role play as leaders and are required to organize staff positions within their group to solve a variety of problems including task organization, movement of the unit, and training.

● **DeLong Floating Barge Instruction**—To close a doctrinal gap in USAES instruction, a DeLong "A" barge was brought to Fort Belvoir and appropriate courses of instruction incorporated for employment, siting, construction of related facilities required on shore, and operational problems.

What are some of the future USAES Training Objectives? Read on—

● **Army Training Programs and Army Training Tests.** New Army Training Programs and Army Training Tests will be developed using systems engineering for all types of engineer units, Priority of accomplishment includes:

—Rework of ATP 5-35T, Non-divisional Engineer Combat Battalion.

—Construction Engineer Battalion.

—Divisional Engineer Battalions (Airborne, Armored Mechanized Infantry, Infantry, Air Cavalry, and TRICAP).

—Engineer Companies, Separate Infantry Brigades (Infantry, Armored, and Airborne).

—Engineer Combat Support Companies, Light Equipment, Panel Bridge, Float Bridge, and Land Clearing.

—Engineer Command Units.

—Engineer Combat Service Support Companies (Construction Support, Pipeline Construction Support and Construction Dump Truck, and Water Supply).

● **Non-MOS Army Subject Schedules.** New Non-MOS ASubjScd's will be developed using systems engineering for mine-countermines, camouflage and field fortifications, map reading, security of unit work area and work site, assault phase of river crossing opera-

tions, floating bridges, fixed bridges, T/O horizontal construction, explosives and demolitions, rigging, engineer reconnaissance, and engineer power tools.

- Trade Union Recognition—Implement union recognition with IUOE (International Union of Operating Engineers) and register with the Department of Labor. Extend union recognition to other engineer skills.

- Engineer Literature—Redesign the family of engineer manuals for the soldier, commanders, and staffs. For example, under this concept a family of manuals may be written for camouflage and field fortifications; one oriented for the engineer soldier; one oriented for battalion and company commanders; and a technical manual oriented for the battalion staff. A second goal for literature is to develop separate handbooks for combat and construction engineers—a change to FM 5-34.

- Engineer Dynamic Training Council—The council will continue to assess the engineer training situation and publish annual reports based on information gathered by the Field Feedback Team.

- How to Teach Team Training—A course of instruction for inclusion in officer and noncommissioned officer courses is to be developed on "How to Teach Team Training."

- Field Feedback System—The Field Feedback Team will be visiting USAREUR in March-April 1973 and make follow-on visits to CONUS Units in CY 1973. Cyclic visits to selected engineer units worldwide will be performed in future years to continue to refine and update data needed for the systems engineering of all training development.

- Multi-Media Instructional Material—Future instructional materials, both resident and nonresident, will be developed to best capitalize on the latest trends in multi-media methods, i.e., sound-slide, video tape cassettes, time-lapse motion picture, ITV, and programmed tests. Pilot multi-media programs will be developed for individual and unit training that can be used by units in the field.

- Expanded Reserve Component Support Program—Major efforts will be focused on: continued presentation of special non-POI instruction, particularly in the area of staff training; establishment of scheduled special POI courses aimed at teaching teachers to instruct in specific subjects; greater employment of mobile training teams; and extensive liaison with Reserve Component engineer units.

- Computer Assisted Instruction. CAI can be defined as "a man-machine interaction in which most of the teaching functions are accomplished by use of the computer in direct support of a training situation." The computer modes will be used for computations, logical problem solving, simulation and gaming, drill and prac-

tice and tutorial dialogue. For example, it is envisioned that CAI will be used for simulation and gaming in such areas as barrier planning, PERT and CPM, and tutorial dialogue to teach Advanced Instructor Training.

- Revision of EOBC Curriculum—The EOBC will be changed to an MOS producing course of 12 weeks duration. Upon completion of systems engineering EOBC will include a common phase of instruction for all students plus a combat engineer track producing a 1331 MOS and a construction track producing a 1328 MOS. It is envisioned that at some point during the first four weeks of instruction, the students will be designated for the combat or construction track based upon personal preference, educational background, and Army requirements. As a spin off of this curriculum change, the Engineer Construction Officer Course (ECOC) will not normally be available to immediate EOBC graduates, but probably will be offered on a cyclic basis as Army needs dictate.

- MOS Subject Schedules—Continue to develop systems engineered MOS ASbjScd's with priority to mine-countermeasure and camouflage and field fortifications.

- MOS Career Management Fields—The military personnel center has completed a study regarding an overhaul of the enlisted engineer MOS structure. The study findings and recommendations have been approved in concept for phased implementation as follows:

Phase I, effective October 1973, will include:

- Regrouping of current MOS into career management fields (CMF).

- Interim retention of current MOS code for each MOS.

- Improved format for MOS descriptions.

- New and revised MOS manual.

- Reduction of the number of additional skill identifiers.

Phase II, effective 1 July 1976, will include:

- Introduction of a new seven-to-nine digit MOS code.

- Complete revision of MOS manual begun in Phase I.

The USAES will be making future input for the MOS manual and for revision of specific engineer MOS's. The USAES has recommended that:

- Four basic career management fields be established: 12 (combat engineering); 51 (construction engineering); 81 (topographic engineering and Map Reproduction) to parallel the three primary types of engineer units, combat, construction, and topographic battalions; and 52 (Power Production).

- A single career management unit be established



in OPO in the interest of efficient and personalized personnel management of the engineer non-commissioned officer.

—MOS 12C and 12D be combined into one MOS. MOS 12B be divided into two MOS's: 12B and 12S. 12B (Combat Engineer) be redefined to include expertise in camouflage and field fortifications while 12S (Sapper) would be an expert in demolition and mine-countermeasure warfare.

—Certain low density MOS's be converted into additional skills for higher density MOS's, e.g., Sawyer (57D) would become an additional skill for a Carpenter (51B). These skills would be identified by an Additional Skill Identifier (ASI).

● Training Extension Course, Phase II (TEC II)—The USAES is providing assistance to combat arms schools in developing high quality, self-paced, audio-visual training extension courses to assist in obtaining and maintaining MOS proficiency for 11B, 11C, 11D, 11E, 13B, 13E, 16P, and 16R. These training extension courses will provide: small unit commanders with ready access to audio-visual instruction and instructor guides specifically designed to assist the commander in providing MOS training to small groups; and the individual soldiers and small unit commanders with an improved method of determining training deficiencies in MOS proficiency subjects. The sponsoring agency, the Combat Arms Training Board (CATB), plans to extend this program including engineer MOS's. The USAES in concert with the CATB is investigating the feasibility of initiating the development of certain engineer training extension courses in FY74.

The preceding litany of training accomplishments and objectives reflects the kinds of training improve-

ments necessary to the revitalization of training for the new All Volunteer Army. Today's better educated and more socially conscious soldier deserves training techniques commensurate with his aptitude and interest levels. The pretechnological platform, podium, pointer, and poop syndrome is no longer viable in the training environment of the Modern Army. In recognition of today's requirements, the USAES has dedicated much of its time and effort toward meeting current and future training needs.

We hope this up-date has provided an insight into what has happened in the recent past and into the general direction training is taking at the USAES. Earlier we implicitly solicited your comments on what would follow. Let us now make that request explicit. Please share with us and the rest of the Army your ideas, concepts, and opinions regarding training improvements. 

Major Don W. Barber is the Chief of the Unit Training Branch for the Deputy Commandant of Combat and Training Development at the Engineer School, Fort Belvoir, Virginia, and is a member of the Dynamic Training Council. Since entering the Army in 1962 and receiving an RA commission, he has served in a number of engineer assignments including Special Assistant to the Commandant of the USAES, Lieutenants Assignment Officer for the Engineer Branch, the U. S. Navl Support Force for 16 months in Antarctica on the ice, Construction Staff Officer in Vietnam, and with the 27th Engineer Battalion. He has attended the Engineer Officer Basic Course, and the Airborne and Ranger courses. The major also attended Graduate School at the University of Tennessee in 1966 and the Command and General Staff College in 1970-1971.

518TH NAMED OUTSTANDING ENGINEER COMPANY OF 1972

The Society of American Military Engineers has named the 518th Engineer Company, U. S. Army Forces Southern Command, Fort Kobbe, Canal Zone, winner of the Itschner Award for 1972.

Given annually by the Society, the award is presented to the Army Corps of Engineers unit it selects as the most outstanding during the year. The Itschner Award is named after the former Chief of Engineers and past president of the Society, Lieutenant General Emerson C. Itschner.

The 518th Engineer Company (Combat) is a separate unit in the 193rd Infantry Brigade without the support of an engineer battalion. It not only supported the 193rd but also was the sole engineer company supporting a theater army.

Lack of a parent engineer battalion did not handicap the 518th in 1972. Its leaders developed dynamic training, education programs, and devised realistic exercises and tests of the company's engineering skill. The company maintained an excellent readiness posture all year and when an earthquake almost destroyed Managua, Nicaragua, it was fully prepared and ready to lend a helping hand.

The 518th performed with distinction at Managua. The unit's efforts contributed to containing fires that swept portions of the ruined city and provided cleared roads for immediate emergency use and subsequent clearing and reconstruction activity.

When the company arrived at Managua last December more than 50 percent of the entire city had been destroyed by the 30 second quake.

The 518th swiftly went into action because prevailing winds were threatening to spread fire that was raging throughout the central part of the city. Bulldozers were used around-the-clock to clear a 12 block square fire break to segregate the city between sections that were considered destroyed and those considered salvageable. This action provided access roads for fire fighting equipment and also controlled further destruction.

When the fires were under control, 518th engineers began clearing more than 4,000 meters of city streets and, in many instances, entire city blocks. Their dozers stockpiled so much debris that the scooploader and dump truck drivers were able to remove an average of 293 loads daily.

Personnel of the 518th also launched a construction effort simultaneously with the clearing operations. With the help of local citizens, the engineers built a mess hall, latrines, shower facilities, dug a sump and erected tents for two refugee camps. The first camp was called La Ciudad de Esperanza (City of Hope) by refugees. Later, when the emergency diminished, the 518th turned to community action-type projects.

The true quality of the 518th Engineer Company was reflected in its outstanding performance at Managua. The reaction speed, professional and efficient work effort, and willingness to work long hours at arduous tasks, made a tremendous psychological as well as engineering impact upon relief operations in general and on the people of Nicaragua in particular.

The unit was praised by the U. S. Ambassador to Nicaragua, the Honorable Turner B. Shelton, the U. S. State Department, former Secretary of Defense, Melvin R. Laird, and the Nicaraguan government for its work at Managua.

Ability to get a job done with excellent results in a tense and demanding situation, combined with matchless esprit, made the 518th deserving of the highest recognition and this coveted award.

The Itschner Award Selection Committee also named two other companies to receive honorable mention for their fine engineering performances during Calendar Year 1972. These commendations as runnerup units for the Itschner Award went to Company B, 79th Engineer Battalion (Construction), 24th Engineer Group (Construction), U. S. Army Engineer Command, Europe, and Company D, 44th Engineer Battalion, 2nd Engineer Group, Eighth United States Army, Korea. e

UNIT OF CHOICE

Colonel Edward R. Ardery

The draft is ended, but the Army continues strong. However, we have to attract the number and right kind of personnel and sell them on the Army. Through the Unit of Choice program (AR 601-210) and Station of Choice, unit commanders have the opportunity to influence the kind of soldiers that will make up their units. Each unit has its own unique situation and the approach will have to vary to fit this situation. Let's take a look at one unit's successful program.

The 931st Engineer Group (Combat), commanded by Colonel James M. Thompson at Fort Benning, Georgia, is made up of a smorgasbord of different type units; the 43d Engineer Battalion (Construction); the 67th Maintenance Battalion (includes a Maintenance Company, Ammunition Company, and two Transportation Companies); and, the Provisional Battalion (includes 586th Engineer Company (Float Bridge), a Personnel Services Company, two MP Companies, and several detachments; Public Information, Finance, Replacement, and MP), and a Fire Fighting Detachment.

The unit was designated as a Unit of Choice in May of 1972 and was authorized to recruit some 1,100 soldiers in some 91 different MOS. By the middle of September, the group had reached its revised goal of 1,045. Practically all are now on board, although some have not yet completed Advanced Individual Training. The mid-January percentage of assigned personnel to authorized strength and the percentage of soldiers who are volunteers for the major units of the group include—43rd Engineer Battalion (Construction), 99 percent on hand, 88 percent volunteers; 67th Maintenance Battalion, 120 percent on hand, 93 percent volunteers; Provisional Battalion, 130 percent on hand, 85 percent volunteers; 586th Engineer Company (FB), 122 percent on hand, 96 percent volunteers.

The profile of the Unit of Choice soldier in the 931st is very interesting. He is—

- Young—18 to 20 years old.
- From the South—reflecting the recruiting area (Florida, South Carolina, Georgia, and Alabama).
- Approximately 29 percent black.
- Approximately 50 percent high school graduates.
- Blessed with good basic and advanced individual training.
- Well motivated.

The well motivated characteristic is the most significant. These soldiers are willing to learn. They want to be soldiers. Here are some of the factors that contributed to the success of the recruiting effort—

● The 197th Infantry Brigade, also located at Fort Benning, was designated in February 1971 as a Unit of Choice and started a strong recruiting program that embraced the same recruiting area as was later allocated to the 931st Group. The Brigade sent out recruiting teams and accomplished civic action projects through the engineer efforts of the assigned 72d Engineer Company (Combat). These teams also demonstrated some of their equipment to the prospective recruits and their families. For example, they have managed to put in operating order several old tanks that were used in World War II that aroused considerable interest. All of these efforts left a favorable reaction to further recruiting when it was the 931st's turn.

● It appears that the rural character of the area in which they were recruiting may have contributed to the success. While not based on hard facts, it was the opinion of many that the small town young man was more attracted to the Army than his city counterpart.

● The nearness to home was also a factor as the young recruit, after he finished up his initial training, was able to count on being in the immediate area where

he could get back and forth to his home and at the same time his friends and relatives could visit him without too much expense.

- Another factor was the lack of racial friction at Fort Benning. The strong race relations program at Benning undoubtedly helped in this respect.

- Another significant factor was the appeal of the material type improvements of the Modern Volunteer Army. In the 931st Engineers, the most attractive feature was the five-day work week with guaranteed time off (coupled with the close to home recruiting area, it meant passes home were possible over the weekend). The second most popular feature was the freedom from Kitchen Police, and the third was the smaller two or three-man housing facilities. (The 43d Engineer Battalion had to pull itself up by its own bootstraps by dividing large squad rooms throughout the post for all units into some 2,700 two- and three-man rooms.

- It was found that the 43d Engineer Battalion had a big advantage by being able to offer some sort of vocational training in the many skills found in the battalion that would be of value upon completion of the prospect's Army service. Of the 91 MOS recruited, the first to be filled were the mechanics jobs and the last two were for the 12 C (Pioneer) and the 55 B (Ammunition Handler). The 931st has placed a strong emphasis on job satisfaction which appears to be the most important single factor as to whether or not the recruit feels that the Army has lived up to its part of the bargain. The 931st has had to actively seek out situations where, for example, the electrician gets electrical work and does not spend his time as a carpenter.

Some of the techniques used by the 931st in their actual recruiting include—

- Keeping close contact with the recruiters, including the local NCO who actually signs the man up and who can direct him either to your unit or elsewhere. This includes helping the recruiter out with programs like a basketball team or demonstration, even though the action benefits the Army as a whole and not specifically the 931st.

- Sending out representatives as canvassers who visit various areas and develop prospects with the recruiter. These canvassers have reflected the best type of people in the unit. Three out of the 10 were black in the 931st. They did have success in sending a young soldier back to his home to sign up his friends. In other cases, the canvassers were left for quite a period of time to get to know the area and to be known by the local populace.

- The engineer units also have a big advantage in being able to provide some benefits to the local activities through civic action. This apparently opened the door to cooperation by local authorities. These projects

whereby the local people furnish the materials, gas, food and lodging have a bonus of being excellent training in providing the opportunity for a small unit to operate alone.

- The 931st also sent out equipment displays that attracted a considerable amount of attention. In several cases, engineer boats from the bridge company provided safety patrols for regattas and float parties. This type of activity developed an atmosphere of good will in the recruiting area that made the recruiting easier. Techniques used by units other than those at Fort Benning which may be adapted to your particular situation include—

- Having a town provide a whole platoon that will stick together in the Unit of Choice.

- Emphasizing the availability of further formal education both at high school and college. Some of the units were able to promise duty time daily for pursuance of these programs.

- Appearances of the following type groups at public functions to include a soldiers chorus, drill teams, bands, rock bands, parachute drops, static displays, basketball teams, state fairs, high school activities, rock concerts, local pageants and festivals, domestic action projects, Army nights at games, and Army night on radio or television.

- Emphasizing facilities that are available to the young soldier on post and in the local area such as drag racing, motor cycle enduro, scrambles and hill climbs, sport car rallies and gymkhanas, flying clubs, glider soaring clubs, skydiving clubs, sailing, fishing, hunting, skiing, camping, mountain climbing, swimming, and golf.

What are the conclusions to be drawn from the experience to date? First, the Volunteer is a reality. With all of the many attractions that the Army can provide, qualified volunteers will enlist if properly approached. Fulfillment of the Army's part of the bargain in terms of job satisfaction and the lesser important promises is a must. Second, we can expect an Army made up of troopers who are well motivated and who will make fine soldiers if given the proper leadership and training. ☺

Colonel Edward R. Ardery, Special Assistant for Training and Logistics, Directorate of Military Engineering and Topography, OCE, was recruited several years ago. He holds a BS from the USMA and an MS for MIT. He served as an Armored Engineer in WWII, an Engineer Advisor in the Korean War, and in the US Army Engineer Construction Agency, Vietnam. He commanded three Engineer battalions, latest being the 78th Combat Battalion and the Triple Nickel Engineer Combat Group. The colonel was the designer of a proposed 80-foot AVL B.



Bridging

ENLISTED CIVIL SCHOOLING GOES UNDER NEW MANAGEMENT

DUE TO A RECENT REORGANIZATION, the Enlisted Undergraduate Training and Degree Completion ("Bootstrap") Programs are now being managed by the Education/Professional Development Division (DAPC-EPC-E) of the Assistant Directorate for Enlisted Career Management, Enlisted Personnel Directorate. These two programs remain unchanged by the creation of the new office. The Enlisted Undergraduate Training Program continues to consist of two years of college at Army expense. However, this program is restricted to four disciplines—ADPS, Business Administration, Engineering, and Law Enforcement. Soldiers interested in furthering their civilian education also should consider the "Bootstrap" program where opportunities are more numerous than in the fully funded Enlisted Undergraduate Training Program. For example, there are still some "Bootstrap" spaces left for Fiscal Year 1973. "Bootstrap" is for enlisted men and women who can complete their associate degree in six months or their bachelor's or advanced degree in 18 months or less. A letter of acceptance from an accredited school indicating the period of time to complete the requirements for a degree is necessary. Potential applicants should read AR 621-1 (Training of Military Personnel at Civilian Institutions) and talk with their education advisor before applying. Questions which cannot be answered by these sources may be addressed to HQ DA, Chief, Education/Professional Development Division, ATTN: DAPC-EPC-E, Washington, D. C. 20310.

QUALIFIED PERSONNEL NEEDED TO FILL DRILL SERGEANT SLOTS

THE DRILL SERGEANT is the living image of the Army during the formative weeks when the trainee is transformed from civilian to soldier. The drill sergeant builds the foundation upon which the soldier will succeed or fail during the remainder of his military life. The responsibilities are great! These responsibilities include developing leadership, motivation, morale, esprit de corps, and professionalism in the trainees in Army Training Centers. If a soldier can measure up, the challenge, responsibility, and the rewards of drill sergeant duties can be his for the asking. The Army needs drill sergeants! To qualify, a soldier must be a noncommissioned officer in the grade of E-5 through E-7; be fluent in English; have a General Technical Aptitude Area (GT) score of 100 or higher (score may be waived to 90 depending on other qualifications); high school graduate or equivalent; score at least 300 on the Physical Combat Proficiency Test (PCPT); weight within the limits prescribed in Table I, App III, AR 40-501; maximum physical profile of 111221; good military bearing and leadership ability; no signs of emotional instability and no record of disciplinary action that would adversely affect an individual's ability to perform as a drill sergeant. Applications must be submitted prior to completion of a soldier's first year of current Continental United States assignment. All personnel serving in overseas commands should apply before or during the eighth month prior to their Date Eligible for Return from Overseas (DEROS). Applications will be forwarded from the installation directly to DA attention: DAPC-EPC-CI. Approval of the application means attendance at one of the Drill Sergeant Schools—Ford Ord, California; Fort Knox, Kentucky; Fort Polk, Louisiana; Fort Leonard Wood, Missouri; Fort Dix, New Jersey, or Fort Jackson, South Carolina—for six weeks of special training. Those who successfully complete the course will be awarded the drill sergeant MOS-OOF and start receiving an extra \$75 Special Duty Assignment Proficiency Pay per month while serving in an authorized position. In addition drill sergeants are issued supplemental uniforms that are laundered and cleaned free of charge. Individuals should submit their applications in accordance with Section XV, AR 614-200. A true copy of a soldier's DA Form 20 must accompany each application.

the Gap



ENGINEER SCHOOL PROPOSES COMPANY COMMANDER PREPARATORY COURSE BY CORRESPONDENCE

IN AN EFFORT TO BRIDGE the so-called "company level gap" in the Army Officer Engineer System, the Engineer School has recently proposed a Company Commander Preparatory Course and has received Continental Army Command's blessing for the plan to administer this course by correspondence. The course is designed as an interim measure to assist both potential and active company commanders by furnishing them with instructional material in subject areas that are pertinent to the efficient discharge of their responsibilities. A total of 49 credit hours is included in the course to provide the company commander with a comprehensive knowledge of personnel management, military justice, company administration, supply, maintenance, intelligence fundamentals, training management, race relations, and drug abuse. Correspondence courses provide students with a highly flexible mode of study with the inherent advantage of working at their own speed whenever the opportunity presents itself. Unlike most other courses, the Company Commander Preparatory Course is comparatively short and can be completed in a few weeks during the officer's spare time. Interested personnel may enroll by submitting a completed DA Form 145 (Army Correspondence Course Enrollment Application) through channels to the Commandant, USAES, Atten: DNRI, Fort Belvoir, Virginia 22060.

ARMY POLICY PROVIDES COMMAND CREDIT FOR TRAINING CENTER DUTY

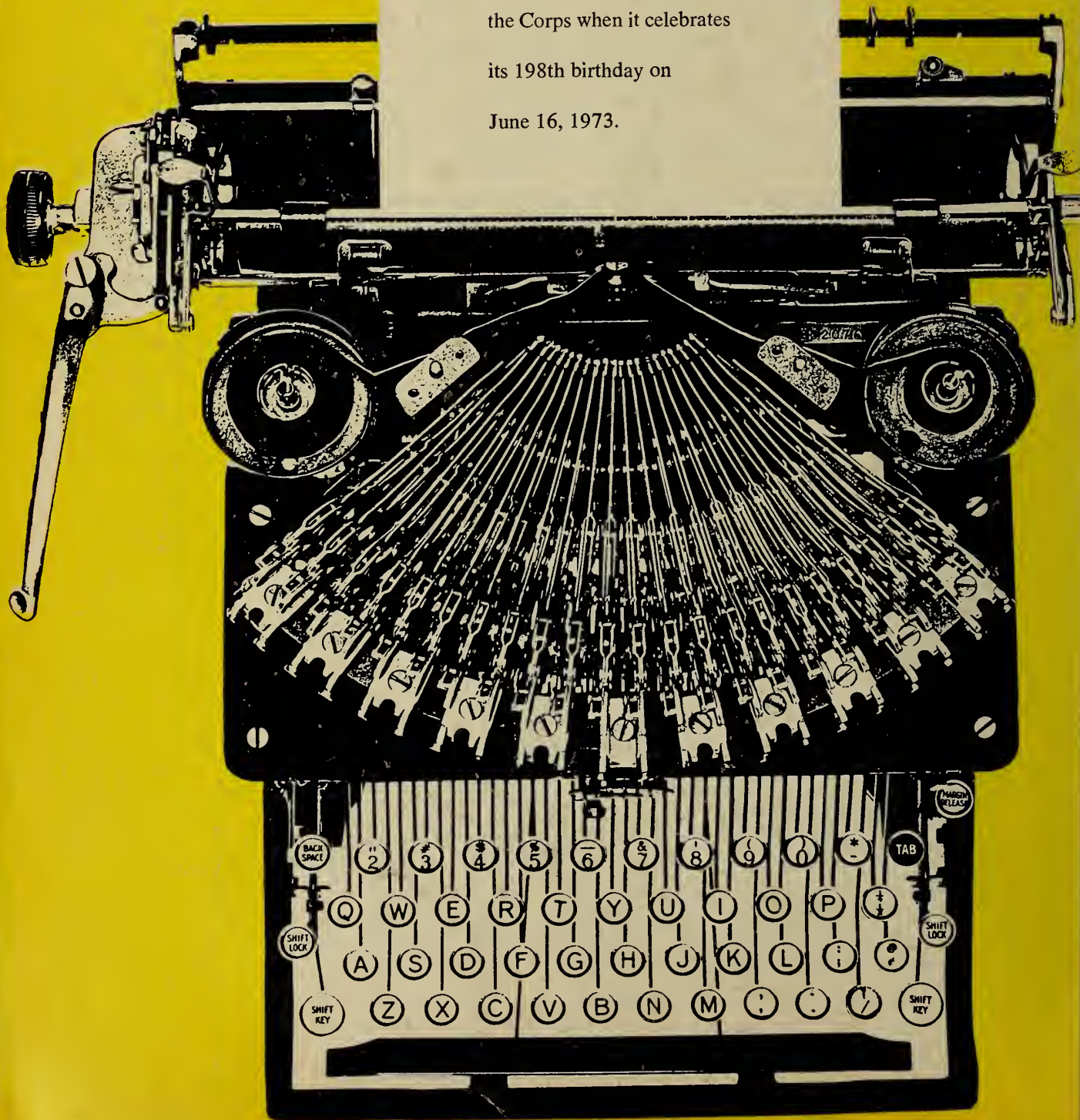
MANY LIEUTENANTS AND CAPTAINS erroneously believe that a training center assignment will not enhance their career pattern. This is not true. Department of the Army policy pertaining to command and command equivalent duty is established by AR 624-100, in operating instructions for the Office of Personnel Operations, and in letters of instruction to Army Promotion Selection Boards. The policy provides that command in training centers, posts, Army confinement facilities, hospitals, installations, and similar organizations will be considered the same as other command duty. This policy is strictly adhered to by the Office of Personnel Operations in maintaining statistics of officers with command experience.

DA MAKES DECISIONS ON STABILIZATION PERIOD OF COMPASSIONATE REASSIGNMENTS

THE MAXIMUM AUTHORIZED STABILIZATION period for compassionate reassignment is one year. Not all compassionate reassignments authorize this maximum period, and in a few cases, no stabilization is authorized. After approval at Headquarters, Department of the Army, the assignment instructions directing a compassionate reassignment will specify the period of stabilization. Commanders and custodians of Military Personnel Record Jacket (MPRJ) should remember that the Assignment Eligibility and Availability (AEA) code "U" must be reported on DA Form 1-1 in accordance with rules 35 and 36, table 5-3, AR 640-2 (Qualification Records and Management Data Reporting) for approved stabilizations in conjunction with compassionate reassignments. The AEA code "U" remains in effect until the specified stabilization period ends and then it is automatically withdrawn. If the individual's problem for compassionate reassignment is resolved prior to the end of his stabilization period, the custodian must immediately withdraw the AEA code "U" and enter an appropriate AEA code. Individuals receiving permissive reassignments are not stabilized and their eligibility for reassignment, especially foreign service, does not change. They will be reported in the appropriate AEA code during the permissive assignment period.

HAPPY ANNIVERSARY

As the fledgling engineer
magazine enters its third
year of publication, its
staffers would like to
take "time out" to salute
the Corps when it celebrates
its 198th birthday on
June 16, 1973.



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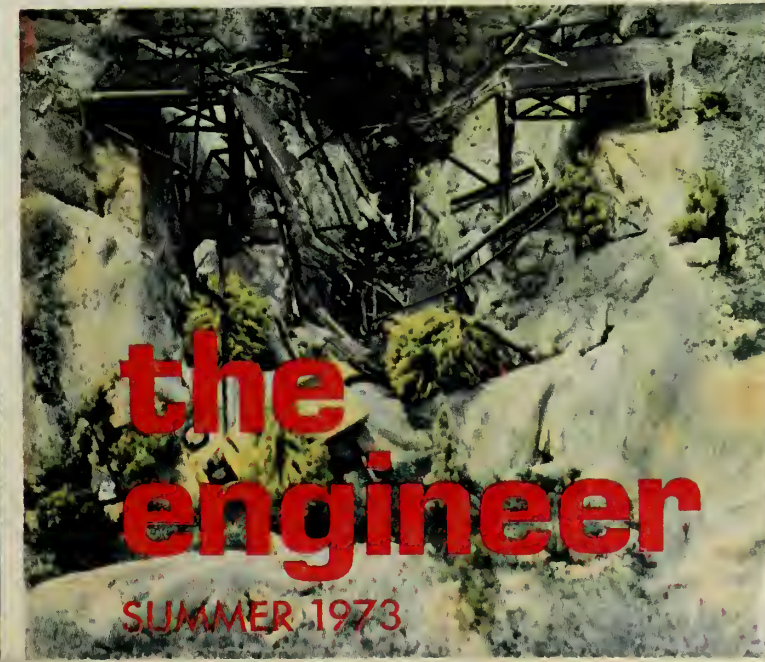
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CHIEF'S BRIEFS.....

Walker Keith Armistead, the U.S. Army's eighth Chief Engineer, was born in Virginia about 1780.

This former Chief of Engineers became a cadet in the old Corps of Artillerists and Engineers and continued as a cadet in the new Military Academy when the present Corps of Engineers was established in 1802. Armistead was the third person to graduate from the newly constituted Academy at West Point on March 3, 1803.

He was appointed a second lieutenant in the Corps of Engineers upon his graduation from the Academy. Rising swiftly up the promotion ladder, Armistead reached the grade of lieutenant colonel during the War of 1812. During that war, Colonel Armistead held an assignment as the Chief Engineer of the Niagara Frontier and for the forces defending the Chesapeake Bay.

Before and after the War of 1812, the colonel served as Superintendent Engineer of various coastal defenses. He was promoted to the grade of colonel and subsequently was named Chief Engineer on November 12, 1818.

When the U.S. Army was reorganized in June 1821, Colonel Armistead was replaced as Chief Engineer by Major General Alexander Malcomb. He was reassigned as an officer in the 3rd Artillery.

The colonel was breveted a brigadier general in 1828. Back in combat again in 1840-41, General Armistead commanded the Florida Army and led it in the fight against the Seminole Indians. He also later commanded the 3rd Artillery.

General Armistead was the father of the gallant General Lewis Armistead of the Confederate Army, who was killed as he led Pickett's charge at Gettysburg.

Brigadier General Walker Keith Armistead died at Upperville, Virginia, October 13, 1845. 



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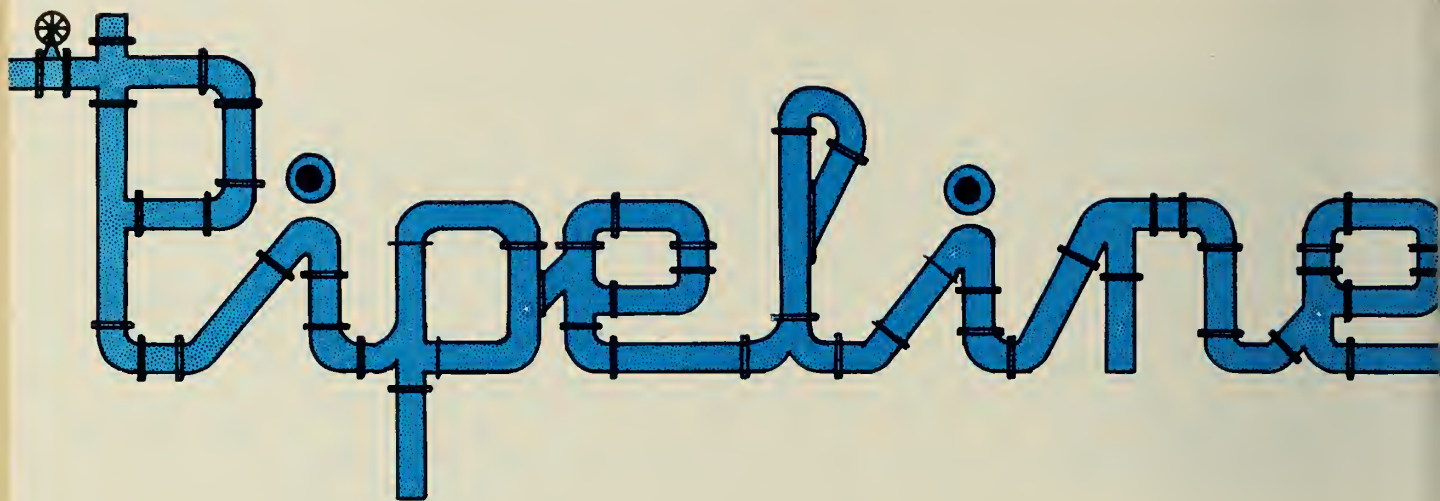
John W. Savage, Jr.

The Engineer is an authorized quarterly publication of the U.S. Army Engineer School. It is published to provide factual and in-depth information of interest to all Engineer units. Articles, photographs and art work of general interest may be submitted for consideration to: Editor, The Engineer, USA Engineer School, Fort Belvoir, Virginia 22060. Views and opinions expressed herein are not necessarily those of the Department of the Army. Use of funds for printing of this publication has been provided by Headquarters, Department of the Army, July 11, 1969.

Subscriptions to THE ENGINEER magazine are available through the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Annual rates are 2.50 for mailing to a domestic or APO address and \$3.25 for mailing to a foreign address. Individual copies of the magazine are \$1.00 each. Checks should be made payable to the Superintendent of Documents.

ABOUT THE COVER

The late author Ernest Hemingway's classic story "For Whom The Bell Tolls" inspired Art Director John Savage, Jr., to build this diorama. In order to simulate the stop action photography seven separate powder charges were used. The vehicle is a 1.35 scale of an Opel "Maultier" that was used by both sides in the Spanish Civil War.



ENGINEERS USE FIBROUS MIX ON LIBBY DAM

The concrete deck of the Libby Dam Project visitor overlook facility, near Libby, Montana, had poor surface drainage and had become badly cracked.

Conventional removal and replacement of the deck would have been an awkward and expensive task.

A thin 1½ inch overlay of fibrous concrete was suggested by the Army Corps of Engineers' resident Office at the construction site and accepted by the Corps' District Office in Seattle as the repair action.

The deck was divided into three sections for a total of 2,000 square feet of surface area.

Improving drainages through grade control required variances in the overlay thickness of from 2¾ inches to less than 1 inch.

The overlay was accomplished in October 1972. It was decided to overlay some of the expansion joints that were in the original concrete surface. A metal manhole lid was also overlaid.

By placing a plastic sheet between the metal lid and the fibrous mix, a removable concrete disc was cast in place. A more architecturally pleasing surface resulted in the final

overlay with only two expansion joints and no exposed metal.

The fibrous concrete was mixed and transported in eight cubic yard rotating-drum transit trucks from a local batch plant to the job site.

The concrete contained 1.19 percent steel fibers by volume. These fibers (.010" x 1") were added at the batch plant sprinkling them onto the aggregates as the conveyor belt filled the mixer trucks.

The cement, water, and air were simultaneously added and mixed.

After discharge from the truck, workmen used garden rakes and shovels to spread the mix. A vibrating screen was utilized to consolidate the mix and obtain the proper grade.

Standard construction techniques and tools were used to finish the slab.

The finished surface is skid-resistant and has virtually all fibers covered. There is no evidence of cracking, objectionable rust stains, bleeding, or fibers sticking from the surface. The 5.3 sack mix used contained 226 pounds of fly ash per cubic yard. Modulus of rupture at 28 days was 1290 p.s.i. with an average compressive strength of 6160 p.s.i.

Strengths at 90 days are expected to be 1700 p.s.i. modulus of rupture and 8600 p.s.i. compressive strength.

All labor involved was union help and none of these men had previously been exposed to fibrous concrete.

A finishing foreman explained that although his men worked harder in order to handle the fibrous mix, the time involved was no different than would have been necessary with normal concrete. The cost to furnish, place, screen, finish, and cure the fibrous concrete and to install the necessary expansion joints was \$1.22 per square foot. This cost includes labor, equipment, travel, and contractor profit.

Additional expenses for winter protection were incurred but are considered incidental to the actual overlay work.

84TH'S TROOPS GET GET SHOOK UP BY EARTHQUAKE

On the subject of pure terror, Mother Nature can often be the best teacher.

At least two dozen GIs from the 84th Engineer Battalion (Construction) received an unscheduled lesson on the subject when an earthquake rocked the Big Island of Hawaii beneath them and rumbled the other Hawaiian Islands.

The men, permanently stationed at Schofield Barracks on Oahu, were working on a civic actions project

involving the construction of a troop service building at Boy Scout Camp Honokaia near there when it hit. The camp is about 25 miles from the area the quake originated and because of its location, it, like other coastal areas, was especially hard hit.

Inside one of the two existing structures at the camp was Bravo Company's 1st Construction Platoon.

Using hand tools and their backs, the men joined county crews in clearing landslide-blocked Highway 24 going into Waipio Valley. It was opened early with their help to one-lane, four-wheel drive traffic.

The large quake, which measured 6 on the Richter Scale and lasted 15 minutes, was the climax

following two or three smaller tremors earlier in the week. In fact, while attending a movie in town one evening, the engineers had to evacuate the theater during one of those tremors.

Following the major shock, too, there were several after-rumblings. One sent the construction crewmen running from their tents set up in a eucalyptus grove near the work site.

Another 75-man crew from the 84th was working on the construction of helicopter pads at the Pohakuloa Training Area when the earth started to rock. Nestled in the middle of the island and protected by 13,796-foot Mauna Kea, PTA was shaken, but not affected seriously, and work went ahead on schedule.

AIRFIELD MATTING IS AVAILABLE TO ENGINEER UNITS

The Army's Director of Military Engineering and Topography says he has found that airfield construction training is being hindered by a lack of airfield matting.

Brigadier General Wayne S. Nichols and his staff discovered the problem during recent training visits to engineer units.

He points out that the matting should not be too difficult to obtain and offers guidelines on how to get one of three available items:

1) Mat, Set, Landing XM19, LIN M15665, FSN 5680-089-5920; U/I Set; 2) Mat Set, Landing XM18, LIN M15665, FSN 5680-089-7260, U/I Set; and 3) Mat, Set, Landing, Nonperforated (M8-A1) LIN M15703, FSN 5680-782-5577, U/I Bundle.

Units can obtain matting for training, subject to item availability, on renewable loans for periods up to 180 days.

The requests and justification for the loans should be forwarded through command channels to HQDA (DALO-SMS-D) Washington, D.C. 20310.

Funds must be available to pay transportation costs, any costs incurred by the depot, and cost of replacing items damaged during training.

If less than a complete set of aluminum matting (VM18 or XM19), which contains 125,000 square feet of matting, is desired, the appropriate components listed in Chapter 5, SB 700-20, in the quantities needed, may be requested.

Units can obtain matting for airfield and heliport projects simply by submitting a requisition through normal supply channels. An approved project should be cited as justification.

Additional information on airfield matting may be obtained by contacting HQDA (DAEN-MEPO) Washington, D.C. 20314.





STOP-16

JUST COMPUTERIZED

Sir/I read with much interest the article titled "Combat Security-Camouflage" that appeared in the Winter 1973 issue of your publication.

There is a lot of good information but I do not go along with the computer color matching program it explains on page 20.

If you will check what this computer program does, you will find that it has not eliminated the inefficient, 'cut and try' process. It has just computerized it. It is still 'cut and try'--and still inefficient.

RAY K. WINEY
UNIROYAL
MISHAWAKA, IND

DRILL PAY

Sir/In the Winter 1973 Issue of the engineer on page 29 mention was made of '... paid time for training ...,' and I would like to make the following recommendation. All officers, key NCO's and key enlisted personnel be authorized drill pay for voluntary attendance at Headquarters Planning Sessions. These sessions are now required by higher headquarters (brigade and division) SOP's and they are usually four hours in duration. It would provide great incentive for retention and motivation for advancement to higher grades.

Since the Vietnam War is partially over and required expenses have been reduced and the emphasis is leaning toward the Modern Volunteer Army, I feel the necessary funds should be allocated for this type of incentive.

I would appreciate it if you could inform me if there are any other channels to which I can direct this recommendation.

ROBERT L. PATTWELL, JR.
CPT, CE, NY, ANG

Captain Pattwell/Congress, in passing the Fiscal Year 1973 Defense Appropriations Act, did provide funds for additional drills for staff officers, preparation of training, and other readiness training. The Army had requested \$19.8-million for both Reserve Components for these drills, and the Congress appropriated \$13.6-million.

With a greater strength in its Early Mission units, the Army National Guard was able to authorize additional training drills for those units only. The U.S. Army Reserve authorized pay drills for training for almost all of its units.

To date the following Engineer units in the USAR have been given DA approval for additional readiness drills: 411, 881, and 980 Engineer Battalions; HHC 315, and 493 Engineer Groups; 277 and 352 Engineer Companies.

The Department of the Army has recognized the value of the additional drills, which if judiciously used, should significantly improve readiness of the Reserve Components. The FY 1974 budget estimates now before the Congress again requested funds for this type of training.

This information was provided by the Office of Reserve Components, Department of the Army. rgm

MANY THANKS

Sir/As a Public Affairs officer engaged in the image building process of the Louisiana Army National Guard I would like to comment and commend the editor and staff of the engineer.

The Fall 1972 issue of this publication was the first I had the occasion to review. The art work, layout, and contents were excellent and, in my opinion, represent expertise and professionalism.

ERNEST N. SOUHLAS
CAPTAIN, LaANG
NEW ORLEANS, LA

FORTS! FORTS! FORTS!

Sir/While on active duty in Europe I become acquainted with your publication and decided I would like to try and publish an article in it.

I am a professional city planner who served as Chief of Master Planning at HQUSAENGCOMEUR from June 1970 through July 1972. In that period, as an assignment and a hobby, I researched the 14 post-Napoleonic Forts which surround Ulm, Bavaria and found that they have been at least peripherally involved in wars from Napoleon through the Cold War!

I have written an article on the forts for your publication. Your magazine is an outstanding product and I would enjoy being part of it.

I left active duty as a captain in December, 1972 and am now both in the Reserves (in Buffalo, New York) and a Ph.D. candidate at the University of Waterloo, Ontario, Canada.

JOHN R. MULLIN
CAPTAIN, USAR
KITCHENER, ONTARIO
CANADA

Captain Mullin/We expect to run your outstanding article sometime in the future. the editor

DEMOLITION SUPPORT:

"ONE ARMY STYLE"

Captain John A. Stockhaus

Captain Guy Donaldson II

The "One Army concept" has been around for some time but its thrust has never been stronger than at present. The mission of the Army and the resources required to accomplish that mission demands strong professional Reserve Components that are capable of shouldering part of the burden. "Mutual Support" is a facet of the "One Army Concept" that conveys current doctrine and technical expertise to the Reserve Components at their home station. This type of direct action benefits both Active and Reserve components.

A landmark of Mutual Support was the demolition of the Castle Bridge in Thomaston, Connecticut by the 242d Engineer Battalion, Connecticut National Guard, commanded by Lieutenant Colonel Harry T. Jarrett.

The Castle Bridge was an abandoned multi-span highway bridge located on the Naguatuck River in the impounded area of the Thomaston Dam. The demolition of this bridge was requested through the New England Division of the Army Corps of Engineers. Colonel Jarrett and his staff devised the demolition plan which called for the reduction of the bridge using high explosives. The bridge was to be reduced in such a manner that debris could be removed from the site by a contractor. The coordination of the project was no small task as it required approval from the state government, the New England Division Headquarters, First Army, and the Office of the Chief of Engineers. During this coordination, First Army requested the Engineer School to review and approve the demolition plan and provide on site representation to check charge placement, priming and firing, and to monitor the firing of the charges. The Instructors of the Demolitions Branch, United States Army Engineer School, were anxious to seize the opportunity as this task would provide a test ground for some new concepts, and depth of knowledge for the instructors. This project would benefit everyone involved.

On the weekend of November 18-19, 1972, four Instructors traveled to Thomaston, Connecticut to participate in the demolition project. The first span would be cut and reduced to debris. Troops from the 242d received a field class in detonating priming while waiting for the explosives to arrive from the ASP. With the arrival of the explosives, the troops prepared the span for demolition. The efficiency of the placement operation was no fluke as the 242d had "dry run" the operation on previous weekends using homemade training aids.

Apparently Dynamic Training is alive and well in the Reserve Components. The size of the charges had to be limited to prevent damage to an occupied dwelling 1,100 feet from the bridge. Stringent safety precautions were implemented to prevent curiosity seekers from entering the target area. These procedures were planned and executed by the 242d. The charges were fired dropping the span, and troops contrived to reduce the span to the desired degree of breakage. The results of demolition were analyzed and the second span, over water, was demolished on the weekend of December 9-10, 1972.

Members of the 242d Engineer Battalion executed this operation under the watchful eye of the Adjutant General of Connecticut. Further reduction of the bridge was accomplished on subsequent weekends. The Mutual Support mission was a complete success.

The demolition of the Castle Bridge yielded many benefits beyond the scope of the project. Among the benefits was the fact that Reserve components are capable of conducting excellent training for their troops, and that Reserve Components can provide needed support to active Army Agencies.

The participation of the Engineer School at Fort Belvoir, Virginia, is vital in projects of this type to check out concepts and doctrine in "Real World" situ-



ations and to provide school instructors with in depth knowledge that lends force and meaning to the instruction at the Engineer School. Mutual Support is one way to the "One Army Concept" that yields rich dividends for all participants.

The Demolitions Branch, Department of Applied Engineering, for instance, is often called upon to provide technical assistance and specialized training throughout the Continental United States to active Army units as well as Reserve and National Guard units.

In February 1973, the 76th Engineer Battalion (Construction) located at Fort Meade, Maryland, was assigned the mission of removing five pile bents from a river on the Fort Meade military reservation. The five pile bents had been left standing in the river after the super structure of the timber trestle bridge had been washed away by the flooding of Hurricane Agnes in June 1972. Each bent consisted of five timber piles, approximately 18" in diameter, the lateral bracing still intact.

Although the 76th was proficient in basic demolitions training, this mission required that the timber piles be cut level with the bed of the stream, thus requiring that the charges be placed under water varying in depth from four to eight feet. Realizing the requirement for special training in the use of special purpose demolitions charges under water, the 76th requested that technical assistance be provided by the Demolitions Branch of USAES.

After final coordination and specialized training had been completed, Captains Guy Donaldson II, and Jack Stockhaus, Demolitions Branch, and members of the 86th Engineer Detachment (Diving) arrived at Fort Meade on February 26, 1973 to provide assistance to the 76th in the actual accomplishment of the demolition mission.

To accomplish the mission individual ring charges were prepared on shore for each pile, utilizing overlapping sheets of M-118 Sheet Explosive taped together. Each individual charge consisted of three lbs of M-118 Sheet Explosive and was primed with detonating cord using the Uli knot. The individual charges were nailed in place on each timber pile by members of the 86th. Each charge was then tied into a detonating cord ring main and the system was then detonated utilizing an electrical firing system.

The results of the operation were outstanding in all respects. Each pile was cut completely right at the stream bed level. The cuts achieved on the timber piles were smooth and straight with a minimum of splintering. The piles and bracing were easily removed from the river by winching them on to shore with a bull dozer.

The benefits derived from each organization cooperating in this operation of "Mutual Support" were numerous. The Fort Meade military reservation had an obstruction removed from its waterway thereby rendering it open for future training and recreation; the 76th Engineers received demolitions training by actually performing a live demolition mission, the 86th Detachment received realistic diving training by working with live explosives, and the Demolitions Branch of the Engineer School received further opportunity to test special purpose charges in actual demolitions mission.

These concepts of "One Army" and "Mutual Support" between Active, Reserve, and National Guard units in the field of demolitions have helped to significantly raise the level of engineer training among all units, and have advanced the "State of the Art" of demolitions and explosives techniques throughout the military. 

Captain John A. Stockhaus, who is presently serving as National Guard Advisor in Fort Devens, Massachusetts, was an Instructor in the Department of Engineering Science and Branch Chief of the Demolition Branch, Department of Applied Engineering at the Engineer School at Fort Belvoir, Virginia, from 1971 until January 1973. Upon graduation from Norwich University in 1965, he attended the Engineer Officer Basic Course and Airborne School. A veteran of the Vietnam War, the captain served with the 864th Engineer Battalion and the 102d Engineer Company there in 1966. He also served there again as a Company Commander with the 8th Engineer Battalion in 1968 and with the 2d Brigade, 1st Cavalry Division in 1969.

Captain Guy Donaldson, II, currently Demolitions Branch Chief, Demolitions/Mine Warfare Division, Department of Applied Engineering, U. S. Army Engineer School, Fort Belvoir, Virginia, is a graduate of Auburn University and holds a masters degree from Purdue. He served with the 814th Float Bridge Company in Germany and in Vietnam as Assistant Subsection Advisor for Dinh Quan District and as Company Commander of D Company, 19th Engineer Battalion (Combat) between 1964-1970. He also has attended the Engineer Officer Basic and Advanced Courses and Airborne School.

New Engineering Techniques

Brigadier General Ernest D. Peixotto

The continued development of new weapons systems and doctrine has intensified the need for the development of improved military engineering techniques in an era of "instant" technology discovery.

The requirement to improve the Army's construction capability has never been more essential to ensure the necessary support for combat operations. Offensive operations require more roads, airfields, and helicopter facilities. Defensive plans emphasize the need for better protection of troops and equipment as well as better techniques to blunt the thrust of an enemy attack. The war in Vietnam emphasized the growing demand for engineer support on the modern battlefield.

The Army Material Command and the Corps of Engineers are attacking many of the basic requirements through several of the Army's research and development laboratories. The U. S. Army Engineer Waterways Experiment Station (WES) at Vicksburg, Miss., is responding to six major requirement areas thusly—

- The increased use of aircraft and airmobile tactics, while adding a new dimension and degree of mobility to the battlefield, has greatly increased the need for expedient airfields and helicopter facilities.
- The employment of more lethal direct and indirect firepower by the enemy requires major improve-

ments in the design and construction of protective structures for troops and vulnerable high cost equipment in the combat zone.

- The increased threat of enemy armored mobility to strike cross-country demands better techniques for creating rapid barrier systems.

- Although our Army enjoys increased air and ground mobility, major combat units have greater requirements for the land line of communications (LOC).

- The development of strategic nuclear missiles and antiballistic missile systems demands improved techniques to ensure the protection of these systems from the threat of enemy nuclear attacks.

- The growing reliance on inter and intra theater airlift as well as close air support has increased the need to improve construction methods for major logistic and tactical airfields.

One of the more spectacular areas of progress by the WES is in the development of new expedient surfacing—landing mats, membranes, and dust control materials—for airfields and heliports. As an example, the Army greatly benefited from the timely development of the M8-A1 mat, T-17 membrane, and Penepriime which were used extensively in Vietnam.

The WES has developed a new heavy-duty membrane which is now ready to enter the supply system for use by heavy aircraft wherever soil conditions are suitable. The neoprene coating four-ply nylon fabric, 5/64 in. thick, is a major improvement over the less durable T-17 membrane used in Vietnam. The heavy duty membrane successfully passed rigid AMC Service Tests under heavy C-130 traffic for six months at Fort Bragg. It is anticipated that this heavy-duty membrane will be extensively used in the future for assault airfield surfacing even where previously the light-duty M8-A1 landing mat had to be used.

Two new landing mat systems are also nearing the completion of development by WES to provide a total of three types of mat to meet the official requirements for a light, medium, and heavy-duty landing mat. The requirements are based on the strength of surfacing required to meet the demands of varying sizes of military aircraft. For the foreseeable future the M8-A1 mat will serve adequately as the light-duty mat.

The new medium-duty landing mat, with an aluminum honeycomb core, has already met all structural and operational tests and should be accepted by the Army in the near future. This mat is available in 4-by 4-ft panels and weighs about 65 pounds per panel.

It will support operations of the aircraft.

The new heavy-duty mat, with an extruded aluminum truss core for extra strength, is near the end of the development cycle. Designed to meet the severe wheel loads of the heavy fighter bombers to include the F-111, this mat will undergo service testing during 1973. The mat is roughly equivalent to a 15-in. concrete runway, but this mat runway can easily be placed by troops in a couple of days as the 2- by 9-ft panels weigh only 110 lb each.

In addition to completing the development of medium and heavy-duty mats, a breakthrough has been achieved in waterproofing the system to protect the soil under the mats. This has been accomplished by use of a gasket that fits in the joints of the landing mat. While the mats are designed to support aircraft loads on a relatively soft soil, CBR-4, the collection of water under landing mats reduces the soil strength and ultimately causes a mat failure.

Barriers must be rapidly created by the engineer in support of tactical operations to stop or slow the advance of the enemy. New concepts and techniques are being studied using both nuclear and non-nuclear explosive techniques to produce obstacles such as large craters, destroyed bridges, highways, railroads and tunnels.

A new technique for destroying bridges over water is also under development. Current demolition techniques call for the placement of explosives on the bridge members to cut critical stressed members of the bridge and drop them into the water. A new concept involves the placement of explosives underwater, under the bridge deck. An underwater explosion generates a highly energetic water column above the explosion which is capable of exerting surprisingly large uplifting forces on the bottom of a bridge. These forces not only pick up the bridge deck and move it but as it settles back down it is overstressed and will suffer damage. Again this work is being performed on a scale model using scaled down explosive charges to generate a water column which is analyzed for the energy directed at the bridge. Once completed these studies will provide a means of predicting, for a given charge size at a given depth underwater, the uplift force generated above the water surface. This new concept in bridge destruction must be considered in our design of new bridge systems.

The atomic demolition munition provides the combat engineer with the greatest destructive power imaginable to create obstacles and barriers. The ADM is not new and much work has been performed in evaluating the use of the ADM as a means for establishing a barrier. Recently renewed interest has been placed on evaluating the effects of the ADM

with the dual purpose of determining the smallest yield weapon possible to ensure an adequate barrier while also minimizing fallout and other detrimental effects from an ADM detonation. Experimental work is in progress to provide more precise information on the effects of an ADM at various depths of burial, and as used against targets such as bridges, tunnels, railroad yards, and airfields. Tests have been completed at Ft. Peck, Mont., and further tests will be conducted at Ft. Polk, La.

During the past four years a revolutionary concept in road building has evolved at the WES. The old expression taught at The Engineer School and to Combat engineers, "get the water off and the rock on," has been as sound advice as has ever been taught. The WES has now developed a road system that gets the water off but uses absolutely no rock. It can reduce the Army's need for rock quarries, heavy quarrying equipment, and dump trucks to haul rock from the quarry to the road or airfield site. In place of rock in road construction, the WES has developed a technique for using common garden variety fine grain clay soil. Techniques have been developed where this road can be built across soft marshy areas and support heavily loaded 5-ton truck traffic.

The road is constructed by first placing a plastic membrane on the subgrade. This is followed by placing clay material which can be moved from the shoulders or even from the original roadbed on to the lower membrane. It is spread and compacted controlling the water content to obtain near optimum strength of the soil. Depending on the nature of the subgrade material, a number of lifts of clay material can be placed and compacted to achieve the adequate strength for the traffic required. Once the clay has been compacted, graded, and crowned, an upper membrane is placed first by applying a asphalt emulsion, then covering the road with polypropylene material, and finally applying a second coat of emulsified asphalt on top of the polypropylene membrane. Sand is also placed on the asphalt to help blot the excess asphaltic material.

The design of military structures to withstand a nuclear blast is the subject of an extensive research program at WES. This research is carried out both in the field and in the laboratory at Vicksburg, Miss. In field tests, the WES is the primary Army participant in DOD joint exercises working with the Air Force and the Defense Nuclear Agency. The tests involve the detonation of large quantities of high yield explosives ranging up to 500 tons of TNT. During the past two years, several tests such as MIDDLE GUST, MIXED COMPANY, and DIAL PACK have been conducted. The field tests are model studies of the

blast effects of a nuclear weapon, placed as an air, surface or underground burst in connection with varying geologic conditions. The subsequent blast and shock effects on hundreds of kinds of experimental equipment arrayed around these blasts are examined. Resulting airblast and ground shock effects are measured through basic instrumentation and on actual military equipment and modeled facilities.

The construction of large airfields to sustain a considerable volume of heavy cargo aircraft and to support heavy tactical fighter and strategic bombers is a major engineering effort. Research to reduce the time and cost of these runways promises to be most rewarding. All facets of the problem are under study. The latest practices of the construction industry are being evaluated for military use. New design practices are being tested. The use of commercial construction equipment is being examined. The immediate goal of the pavement research project is to save over \$20 million in a planned runway construction program.

Many new concepts for pavement designs are being evaluated. In the field of flexible pavements, the use of full depth crushed stone, full depth asphalt, and even the use of cement stabilization of the base course material are under test. Preliminary results indicate major savings can be achieved in the thickness required for the same design loading. The thickness savings can be translated into cost savings. In rigid pavements new techniques are being examined for continuous reinforcing of concrete, prestressed concrete pavements, and wire-fiber reinforcing, to name a few. The use of clay wrapped in a membrane is also being evaluated as a replacement for high cost crushed rock as a base course material. Pavement condition surveys are being made on military airfields across the country to analyze the traffic and weather effects on the pavements, their structural integrity, and maintenance costs. About 30 airfields overall are being studied.

Another change in concrete pavements may be possible through the use of fly ash and pozzolans to reduce cement requirements. Fly ash and pozzolans have been used by the Corps of Engineers in the construction of large concrete structures to reduce the cost of cement. In bituminous pavement, the use of asphalt, lime, and cement for stabilization may reduce overall thickness requirements and thus effect a savings in material and construction effort. Lower quality material can also be utilized to achieve another saving when stabilization is employed.

In examining construction practices for rigid pavements, the WES is evaluating the use of slip form pavement and the continuous reinforced pavements now quite common in the interstate highway systems.

Fibrous reinforced pavements are also receiving considerable attention. Immediate adoption of these techniques is not possible under current military requirements. One of the disadvantages of slip form paving is the slump along the edge of the pavement which results as the form moves. This results in a groove down the pavement that does not meet the smoothness specification required to meet Air Force standards. These are among some of the many problems that are being evaluated as well as the key joint between slabs.

The present Corps of Engineers specifications do not provide guidance on many of the recent technological advances in bituminous pavement constructions. Particularly significant are advancements in pavement and compaction of depth lifts of paving mixes up to 8 in., the use of vibratory rollers, and the use of full width pavers of 30 ft or more in one pass. Again we are collecting data from equipment manufacturers, contractors, associations, and actual construction projects as well as our own test programs to evaluate these techniques and see if they meet the military airfield construction standards. Another area of improvement in specifications is the lengthy and detailed requirements in meeting quality control. Improved methods for the contractor providing quality control will also be incorporated.

In all the future looks much brighter for the military engineer in the years just ahead. 

Brigadier General Ernest D. Peixotto is the new Assistant Commandant of The Engineer School at Fort Belvoir, Virginia. His last duty assignment was Director of the U. S. Army Engineer Waterways Experiment Station at Vicksburg, Mississippi. The general was commissioned in the Army Corps of Engineers in 1951 upon graduation from the U. S. Military Academy at West Point, New York. He holds a Master's Degree in Civil Engineering from Massachusetts Institute of Technology and is a graduate of The Engineer School, the U. S. Army Command and General Staff College, and the National War College. General Peixotto has held numerous top assignments in the U. S. and overseas during his military career. He served in Vietnam twice; the first time as the Engineer and Academic Advisor at the Vietnamese National Military Academy in Dalet in 1959 and later as the Commanding Officer, 86th Combat Engineer Battalion operating in the Mekong Delta in 1968. He has held positions in the Research and Development Directorate and as the Special Assistant for Plans and Policy for the Chief of Engineers. He also has served in Iran and in the Panama Canal Zone. The general is a registered professional engineer and a member of the Society of American Military Engineers.

THE MAINTENANCE SYNDROME

CW4 Jean L. Derby



When a weapon malfunctions or a piece of equipment is deadlined during combat, a number of things can happen. All of them are bad.

A soldier carrying that malfunctioning weapon could lose this life. And deadlined equipment means that some vital project—like construction of a fire base—cannot be completed before an expected enemy attack. This means the casualty figure would be much higher than it would have been if that fire base had been completed before the attack. Farfetched examples? Not hardly.

Deadlined equipment has been a major problem for engineers through the years. The primary cause behind delayed engineer construction projects and the resulting rise in construction cost is high engineer equipment deadline rates.

Over the years, engineer equipment has undergone many changes. Today's typical piece of equipment is a sophisticated, complicated machine which requires a well-trained operator and mechanic to keep it operational. The basic causes and the solutions that are necessary to prevent deadlined equipment are the same today as they were when machinery replaced the horse and wagon.

A recent survey and subsequent answers from more than 600 officers and noncommissioned officers at the U.S. Army Engineer School, Fort Belvoir, Virginia, showed that there are four major areas of maintenance effort which directly effect high deadline rates. They are:

- Nonperformance of organizational maintenance.
- Inefficient equipment operation and utilization re-

sulting in abuse of equipment.

- Poor response from the repair parts supply system.
- Shortage of properly trained and motivated maintenance personnel.

Perhaps there are many solutions to deadline rates; some better than others. This article makes specific, and hopefully the best, recommendations on how to conquer the four problem areas.

Let us take them one at a time. The first area of ineffective maintenance has been identified as non-performance of organizational maintenance. It can be controlled through well-supervised motor stables, scheduled preventive maintenance services and a training program for unit supervisory personnel which emphasizes the duties and responsibilities of the junior leader.

An effective preventive maintenance program like any engineer construction project must be based on a solid foundation. And the foundation of an engineer battalion's maintenance program is the unit motor stables.

Commanders and NCO's at all levels know and understand the importance of motor stables but frequently do not believe they can find time to make a personal check of the facilities during the day. Implementation of a good motor stables program depends on the personal effort of every officer and NCO in the battalion.

Motor stables supervision must start at the top. If the battalion commander and sergeant major make a daily check of the motor stables, staff members and

unit commanders will get the message as to the importance of the program.

Of course there are aspects other than maintenance that lend to the efficient operation of an engineer battalion. But, even so, commanders must insure that adequate maintenance is being performed on the unit's equipment while keeping abreast of the day-to-day battalion operations. The best way to do this is by personal supervision and participation in the battalion's maintenance program.

Motor stables are not the complete answer to the maintenance problem. Commanders also must initiate a maintenance training program within their battalions.

Logically, instructors should be the personnel who possess the most maintenance expertise and know-how in the battalion.

The maintenance warrant officers and NCO's should be motivated to provide dynamic on-the-job training to supervisory personnel during motor stables formations.

Senior maintenance personnel should schedule and present a series of formal classes on each type of engineer equipment. One of the most effective methods of getting the instruction across to a class is to use the equipment as a training aid and schedule the tutelage concurrently with maintenance activities. The commander can use this time to make a checklist of deficiencies that normally occur as a result of improper operator maintenance. Armed with this information, a senior commander can quickly impress his unit commanders with the importance he places upon the battalion maintenance program.

The second problem area—inefficient equipment operation and utilization—can be alleviated in part by the application of effective motor stables and training programs. Unless proper maintenance is being performed on engineer equipment, it will be abused from the instant it leaves the motor pool until the moment it returns. In addition, proper supervision through operator training and enforced licensing procedures will greatly reduce the misuse of equipment that is caused through ignorance of proper equipment handling techniques.

Operator morale is also a factor that can cause equipment abuse. Commanders should monitor the number of consecutive days an operator works on the same project. If an operator's morale is low, he may purposely deadline an item of equipment just to get away from the job for a few days.

Maximum utilization of assistant operators, rotation of equipment, and liberal pass policy during slack construction periods will go a long way toward improving the operator's morale and the way he uses his equipment.

The third maintenance problem area—response of the repair parts supply system—is directly related to the Direct Support maintenance capability. The value of any Direct Support maintenance capability is directly dependent upon the efficiency of the Direct Support supply section charged with maintaining the authorized stockage list. Many of the problems encountered with the repair parts system lie either at this level or at the company prescribed load list level where the Direct Support section has training and inspection responsibilities. Many times delay in the availability of repair parts can be directly attributed to organization supply procedures.

The most common causes for the delay in the supply of repair parts are: 1) improper identification of parts; 2) use of obsolete supply catalogs and erroneous stock numbers; 3) failure to forward parts requests immediately; 4) unauthorized use of higher category repair parts manuals at organizational level; 5) inadequate training of maintenance personnel in repair parts supply procedures and catalogs; 6) abuse of the issue priority system and; 7) failure to submit timely follow-ups on requisitions. Many of the causes of these delays are inherent in the table of organization and equipment that mans and equips the section.

An example of the manning and equipment problem is demonstrated in the organic Direct Support maintenance capability of the engineer construction battalion; surely the most valuable maintenance asset available to the commander.

The authorized repair parts specialist—an E-5 position—does not normally provide supervisory ability commensurate with the magnitude of the responsibility. This lower grade NCO is charged with the requisition, stock control, storage and issue of between 4,000 and 8,000 separate line items of repair parts.

This repair parts specialist must maintain liaison with maintenance support activities, provide inspection and training assistance to the units the section supports, transport parts from Direct Support/General Support facilities to the Authorized Stockage List (ASL), and supervise nine parts clerks to accomplish all of these functions.

Often the section is under-supervised and under-manned. To compensate, personnel are assigned from other Direct Support positions. A platoon leader Engineer Warrant Officer, or Ordnance Warrant Officer, often may find himself devoting considerable time to the ASL; a distraction that hinders the performance of his specialized functions. In addition, the section has three trucks and five trailers that are operated and maintained by the supply clerks. This secondary mission generally becomes a full time job, reducing the number of clerks available to perform the

primary mission. Three or four mechanics may be cross-trained to supplement any shortage in repair parts clerks and equipment operators.

All of the aforementioned factors affect the efficiency of the repair parts supply system. Many of these Direct Support problem areas can be resolved only by a concerned and informed commander.

Every commander should visit the ASL area frequently to get a first-hand look at the problem areas. Short question and answer sessions between the commander and the personnel operating the ASL area should quickly give an indication as to the responsiveness of the supply section. Although it is impossible for the commander to personally check the condition of each item of equipment in the battalion, a spot check of the demands on the company prescribed load lists and the demands on battalion authorized stockage lists will give a good indication of the quantity of scheduled maintenance that is being performed.

The fourth and last area of ineffective maintenance—described as a shortage or lack of motivation in maintenance personnel—can be alleviated through the proper assignment of individuals in this military occupational speciality. This is a command responsibility at all levels. Unit maintenance personnel can be found in supply rooms, orderly rooms, mess halls, and out in the field operating equipment.

Operational necessities frequently dictate that certain personnel be cross-trained or retrained in order to meet mission requirements. This sometimes creates a problem. It must be recognized that a potential morale problem can develop when personnel are used outside the field for which they have been trained. So the commander should periodically screen the records of his personnel to insure that maintenance-qualified personnel are being properly utilized. The senior commander also should make every effort to see that key warrant officers and NCO's are assigned at the organic direct support levels.

Of course, the maintenance responsibilities of the senior commander go beyond alleviating the four problem areas that have been discussed in detail. His responsibilities are not as clearly defined as those of the battalion maintenance warrant officer, maintenance NCO or unit commander. Generally the senior commander is charged with overall responsibility for the battalion maintenance program. It would be helpful for the battalion commander in the long run if he would define specific areas in his maintenance program, assume personal responsibility for these areas, and see that they are carried out. This is not to say that he must personally supervise every aspect of the battalion maintenance program. There are, however, several areas he could monitor that not only would keep him

up to date on equipment status, but also would correctly demonstrate his personal interest in the program for the benefit of staff members and unit commanders.

These areas are referred to as the Seven Maintenance Factors at the Engineer School. They are—

- Command.
- Personnel.
- Facilities.
- Equipment.
- Publications.
- Repair Parts.
- Time.

The senior commander has many of the answers to the maintenance syndrome. To insure a low engineer equipment deadline, he must pursue an active and aggressive maintenance program. He must develop his ability to diagnose the cause and prescribe the prevention or cure. Of course, a commander's personal interest in his battalion maintenance program is certainly not a new or unique concept.

The unfortunate fact is that the senior commander's interest in maintenance sometimes begins and ends after he has scheduled motor stables on the battalion work/training schedule. Generally, maintenance is considered subordinate to production. However, the mission-oriented commander must realize that production is directly related to the quality and quantity of the maintenance services that are performed in his unit.

The commander who makes personal contact with his operators, mechanics, and parts clerks certainly increases the morale within his battalion. Also the commander who can diagnose equipment malfunctions, determine the status of maintenance and repair parts activities, and pinpoint ineffective or inefficient areas of the program, can be assured of a low equipment deadline rate.

Maintenance will never take a back seat to the construction mission in a first rate engineer battalion. Furthermore, a first rate maintenance program will guarantee a top-level production program. 

CW4 Jean L. Derby is currently assigned to the U.S. Army Engineer School's Department of Mechanical and Technical Equipment as Chief, Systems Equipment Section. He has served in a variety of engineer maintenance assignments and is a combat veteran of Korea and Vietnam. He saw service in Korea with the 14th Combat Battalion and in Vietnam with the 103rd Construction Support Company and the 577th Construction Battalion in 1966 and 1969-70, respectively. This is Mr. Derby's third assignment as a member of the Engineer School faculty during a service career that has spanned 25 years.

REVISED FM 20-32

Frederick A. Messing



The many changes in doctrine and techniques of mine-countermine operations contained in the Mine-Countermine Study (MICMIS), the STANO Survey and Review (STASAR), Standardization Agreement (STANAG) 2036, and other documents pertinent to mine-countermine operations, necessitated an early revision of FM 20-32, Landmine Warfare, May 1971.

Accordingly, a revision of FM 20-32 was initiated in Fiscal Year 1972 with the express purpose of updating the manual in accordance with the referenced documents. As a point of reference and in accordance with the MICMIS, the term countermine has been redefined. "Countermine" is now defined as: "Tactics and techniques used to detect, avoid, breach, and/or neutralize enemy mines and the use of available resources to deny the enemy the opportunity to employ mines." This new definition was forwarded to the Adjutant General and is now included in the Dictionary of the United States Army (AD) and in the revised FM 20-32.

The MICMIS also contained a recommendation to: "Change the title of FM 20-32 from "Landmine Warfare" to "Mine-Countermine Operations" to give more emphasis to the countermine portion of landmine warfare. This was done and the title of the new FM 20-32 will be "Mine-Countermine Operations."

Additionally, the MICMIS contained a recommendation to: Rewrite and reorganize the FM 20-32 to provide complete coverage of doctrine and operational concepts that apply to countermine operations and to eliminate or move to an appendix all technically oriented information. In line with this recommendation the manual was reorganized into three parts: Part One, Introduction; Part Two, Installation of Landmines and Minefields; and Part Three, Countermine Operations. Thus, the two essential functions have been separated by placing all information on Mining as practiced by friendly forces, in Part Two, and all information on Countermining, in Part Three. Insofar as possible, all technically oriented information in the manual was moved to the appendixes.

Simultaneously, Edition Number 3 of STANAG 2036, a source document for FM 20-32, was also reviewed. As a consequence of changes to the STANAG, changes in the Irregular Outer Edge (IOE) of the Standard Pattern Minefield and changes in the various reports (Intention to Lay, Report of Completion and

Report of Enemy Minefields) were made in the revision of FM 20-32. Added also, were changes concerning the direction in which minefields may be laid (minefields may now be laid from either right to left or left to right); the method of laying mines in the cluster (mines may now be laid on the circumference of the semicircle prescribed for pattern minefields) and permitting the use of barbed-wire concertina for minefield marking fences.

The Surveillance, Target Acquisition and Night Observation (STANO) Survey and Review (STASAR) contained recommendations that STANO equipment be used in countermine operations and counter-countermine operations. To comply with this recommendation, applicable STANO doctrine was extracted from various STANO documents and reports and included in the revision of FM 20-32. A chapter (chapter 10) on available STANO devices which can be used in countermine operations and an appendix (Appendix F) on the use of unattended ground sensors (UGS) to detect enemy engaged in mine laying, or breaching activities have been added.

To include information on scatterable mines, FM 20-32A, Landmine Warfare (Scatterable Mines) has been incorporated into the revision of FM 20-32 and will appear as Chapter 7. Upon publication of the new FM 20-32, FM 20-32A will be superseded.

Chapters on the "Countermining System," "Defensive Countermining Operations" and the "Historical Background of Mines and Mine Warfare" have been added. There are also new appendixes on "Minesweep Operations," Detector and Search Techniques for the Individual Soldier and the Unit" and the "XM57 Antitank Mine Dispensing System."

When the final draft manuscript was sent to the Adjutant General for printing, limited quantities were also sent to those agencies and units providing comments. Additionally, sufficient copies of the final draft were published to provide the Mine Warfare Branch of the Department of Applied Engineering of the US Army Engineer School an interim Training Text for School instruction.

The revised manual was scheduled to be distributed in August 1973, but publication is being held up to incorporate additional changes developed at a worldwide Barrier-Counterbarrier Conference held at Fort Benning in May.

These changes are being staffed as this issue goes to press, so they are not yet approved. They address

the responsibilities of individuals and units, defining more clearly combat arms and engineer roles and introducing an engineer role for training of others. As now written (and subject to change) the new manual would read—

RESPONSIBILITIES:

- All troops, regardless of arm or branch, are responsible for individual countermining actions—visually detecting, avoiding, and reporting of mines and booby traps.
- Combat arms troops are responsible for employment of individual standard US AT&AP mines—arming, disarming, emplacing, and camouflaging—and for hasty neutralization of enemy mines—by detonation or by pulling out with rope or wire.
- Combat arms units are responsible for:
 - Hasty breaching of barriers to include minefields.
 - Emplacing and removing hasty protective minefields.
 - Assisting engineers in deliberate barrier operations.
- Combat engineer units are responsible for:
 - Deliberate breaching of enemy barriers to include minefields.
 - Deliberate barrier operations, with assistance of combat arms units.
 - Technical advice and assistance in barrier/counterbarrier operations.
 - Providing training in barrier/counterbarrier operations.
- In accordance with an approved employment order, combined arms units are responsible for planning and conducting barrier/counterbarrier operations, with advice and assistance from supporting combat engineer units.

This added revision to FM 20-32 is more than just a clarification of language; it is a change of doctrine to make it conform more closely with real world practice and to emphasize the training responsibilities that derive from doctrine. Because of the importance attached to this shift of doctrine, publication of the new FM 20-32 will be delayed until early 1974. 

Mr. Frederick A. Messing (LTC, CE Ret) was, before retirement from Civil Service, a writer-editor, GS 12, with the Department of Doctrine and Training Development, USAES. He recently completed the revision of FM 20-32, Mine-Countermining Operations.

TRAINING THE EFFECTIVE SAPPER

Major William L. Jones



Effective countermine training is almost universally accepted as being in about the same state as it has been over the past 40 years—unsatisfactory. This has created the MICMIS Study which has generated a need for a Sapper Military Occupational Specialty.

The design of a program of instruction supporting an MOS is normally done through a process called Systems Engineering. This involves three basic steps prior to developing the actual lessons. First, the job itself is examined and a list of tasks is prepared showing everything the specialist must be able to do. Second, these tasks are examined to determine where they can best be learned—service school, unit or On-The-Job-Training (OJT). Third, the tasks selected for training are each broken down further into knowledges that are then taught or trained as parts of specific lessons.

In evaluating a program to train an effective sapper, one task; that of finding a mine or boobytrap cannot be analyzed by listing knowledges because no matter what knowledges are listed, the graduate still will not be able to consistently find the mine or boobytrap. When this is the case, the task has not been trained. An easy path is to regulate the task to OJT but now as in the past, the price in combat is too high and the problem is not solved. The program of instruction under development must, therefore of necessity, include this task of finding mines as well as the remaining conventional MOS tasks. This article concerns itself with the training of the unique task of “finding mines and boobytraps.”

Extensive attempts in recent years have been made to determine and analyze the human characteristics or traits which make up the outstanding patrol point men. Whatever enables them to find mines and boobytraps better than others has not yet been isolated. Some individuals are just better at finding mines and boobytraps than others. The real experts that have been interviewed and tested, learned their skills by living real live situations. Their skills were trained and sharpened to a fine edge through individual adaptation, much the same as a child's reflexes are automatically adapted to his environment. These specialists are not constant with each other when they explain why they are more skillful than their contemporaries.

Education of an individual takes many forms other than that normally found in the classroom. Reports by some of our most noted educators document that both humans and animals rapidly learn tasks on their own simply by being put in a situation where they

desire to do the task successfully and the means to do it are available. For a simplified illustration let us put a mouse at location X and food at location Y.

On the first trial the mouse takes an hour and one-half to find the food with obvious difficulty. Subsequent attempts shorten until the mouse learns this maze and gets the food within a few seconds. The mouse is next placed in a new maze. Does he completely start over?—No. The mouse has learned to learn. Experience is transferred and both his initial trial time and his total learning of the new maze are appreciably shortened. Now, if this trained mouse could talk could he really explain why he is faster now? Does he himself really know all the cues he acts upon when he moves through the maze? This principle of the mind automatically learning to adopt a new environment also works with humans, and although the cues providing stimulus are not always identified, learning still takes place.

This theory is currently widely used during military field training but success is dependent on rigid adherence to the following two factors—

- The student motivation must be very strong causing either a fervent desire to be successful or an equally strong fear of failure. The motivation should parallel as much as possible, that of the combat environment for which it is being prepared.

- The learning or training environment must be as close as possible to the real environment. This is difficult as conditions such as fear, fatigue, and time require very careful analysis and preparation and are essential if valid skill transfer is to take place. A seemingly minor compromise can sometimes destroy the environment sufficiently that effective learning transfer does not occur. The student learns to train but does not learn to accomplish the task. These principles can now be applied to the Countermine task "Find an Enemy Mine or Boobytrap."

Motivating men is a leadership problem that is always present in training both in units and at service schools. Most men attempt to do well, but need some inducement to sustain themselves if the environment becomes tough. Sapper training will be complex, physically demanding, and require a high efficiency with detailed accuracy under conditions of stress. The student must work hard to pass the instruction program and then be motivated sufficiently to maintain his skills and knowledge beyond graduation. One proposal is to authorize hazardous duty (Demolition) pay for sapper training, and continuously for sapper graduates who

can maintain proficiency, regardless of their current assignment. Controlled testing with very high minimum standards would be required quarterly or semi-annually to include new information learned by individuals through self-study programs that each sapper needs to continue. These rigid standards, if maintained, will generate an esprit that will sustain the sapper corps—the hazardous duty pay will compensate for the real explosive hazards in this specialty plus provide the needed intense training motivation by providing a very real and tangible loss that will result from failure. I know of no other motivation that will provide the needed desire during and after the course that will provide the needed performance quality.

From the training viewpoint the best environment would be a real one; real mines employed by and against a real enemy using real weapons and ammunition. To save injuries, compromises have to be made, but each compromise must be seriously considered for necessity, and proper compensations. For example, when eliminating the mine itself a training aid must be substituted that looks, feels, and functions the same. The mine is replaced with a duplicate that does everything except injure men. This single substitution is serious. From the motivation point of view fear of failure, needless to say, is drastically reduced. Given the feverent desire to pass the course as outlined in the paragraph above, this compromise can be partly compensated by failing a student and dropping him from the program the fifth time he unsafely detonates a device regardless of the circumstances. This automatic negative motivator parallels closely the concern real mines cause. In theory the first accident should be grounds for failure but the loss of potentially good sappers would be too high. In combat men are hot, tired, and impatient. In training, hard physical requirements, long hours, tight schedules, and a strict cadre can reconstruct many of these hazardous distractors. A third environment pitfall is that individual consistency in the work of the mine layer trains the countermine student in those specific consistencies. By having two or more teams of students, who do not meet, work against each other. Each will develop and employ improvisations based upon their analysis of other teams designed to deliberately deceive. This adds the challenges and diversity that are needed.

A side benefit is the discussion within an installing team analyzing if and how a system being employed could be countered. Thus it can be concluded that to

learn the task of finding a boobytrap it must be learned in the most dynamic realistic fashion possible. The course must be structured around a 24-hour day and be physically and mentally demanding.

In developing a Sapper course using the above ideas the problem of managing and controlling the students arises. To maintain realism the missions must be exceptionally clear with the instructors relegated to quietly grading leadership, evaluating Mine and Countermining techniques, and declaring casualties.

The missions will initially involve simple tasks but ultimately evolve to large area problems with many alternative solutions. The support requirements can be kept to a minimum as most preparation is done by two or more squad-sized student units continuously working against each other. Techniques will grow in sophistication as time passes.

A key reminder need be made at this point. Devices used for training must be installed and removed prior to real equipment failing; in this the installing squad will miss the major portion of the training potential. An example of one exercise toward the end of the course might be—

- SQUAD #1—Move from A to B (distance of six miles) between 6 am and 8:30 am tomorrow. Boobytraps are very likely to be about. This squad has the

alternative of picking several routes, using trails or not.

- SQUAD #2—This squad must outwit Squad #1. Needless to say, the squad roles will soon be reversed. By designating squads or patrols as the basic school training units, graduates will live many examples of dynamic training and as a result will be able to take a wealth of training ideas to their future assignments.

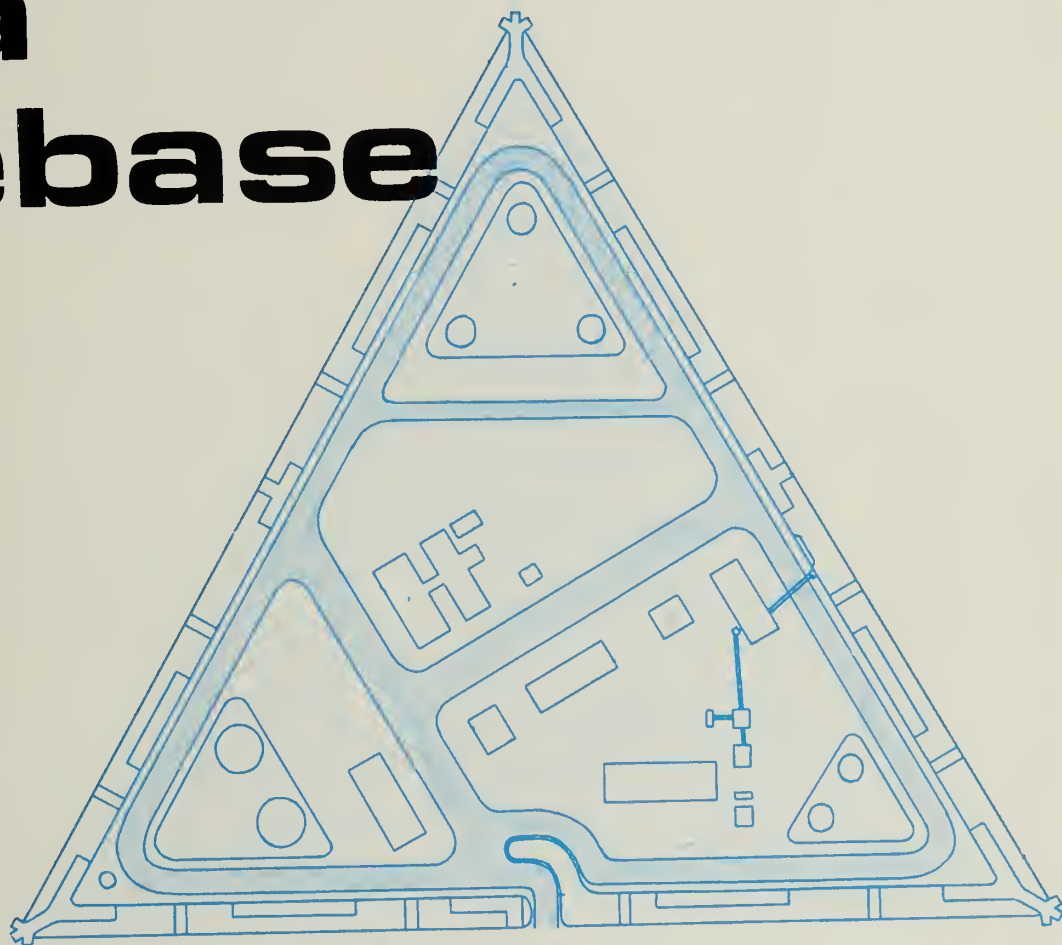
The Sapper program has the potential opportunity to develop a viable countermining plan. If all of the aforementioned constraints and conditions are met, the Army's new Sapper will have pride in his ability and sufficient confidence in his subject that he will become its advocate and inspire confidence wherever he goes.

Major William L. Jones, currently the Chief of the Demolition/Mine Warfare Division, Department of Applied Engineering, U.S. Army Engineer School, Fort Belvoir, Virginia, is a graduate of Norwich University and the University of Missouri at Rolla. He served as a Combat Engineer Company Commander in both the 12th Engineer Battalion, 8th Infantry Division in Germany and with the 27th Engineer Battalion in the Republic of Vietnam between 1964 and 1967. He also later served as the Battalion Executive Officer, 8th Engineer Battalion, 1st, Cavalry Division in Vietnam from 1970 to 1971.

SAPPER COURSE CONCEPT

The course will be of approximately 7 to 9 weeks in duration, rigorous both mentally and physically in its demands on the student. Input requirements and graduation/qualification standards will be very high since the graduate will be considered an expert in theory and practical application of combat demolition techniques, all phases of mine/countermining warfare, and to instruct troops of all arms in appropriate phases of demolitions and mine/countermining warfare. The first two weeks of the course will consist of demo/mine/countermining obstacle planning and design, methods of instruction and physical acclimation with emphasis on the student learning to teach his peers appropriate subject matter. The last weeks will be conducted in the dynamic training mode, and will concentrate on detailed use of all demo/mine/countermining hardware (including foreign materials) and intensive physical development. Throughout the course, the role of instructor will phase from that of the traditional instructor to that of monitor/supervisor; the last 1½-2 weeks of the course will be administered by students under instructor supervision. The use of live explosive/mines in practical exercises will also progress during the course. All students will employ and handle all available US explosives/mines and representative items from foreign nations. Maximum emphasis will continually be placed on stress situations, developing high skill/confidence levels, and producing a professional instructor expert. The major portion of this program of instruction will not be time structured to a 40 hour week but be continuous field training 12 hours per day, 6 days per week. Graduation will be a challenge requiring high motivation and aptitudes.

BUNKER HILL: anatomy of a firebase



Major Peter J. Offringa

The evolution of tactical concepts in Vietnam can be catalogued by the anatomy of the fire support bases associated with them. Overgrown circles, squares, triangles, and stars bear mute testimony to the changing tactics that forged them. Archeologists of the future, working Southeast Asian diggings may well ponder the implications of these oriental Stonehenges.

If there is any meaning in this almost infinite variation, it is the continuous search for the best means of combining flexibility in fire support with security.

The attributes of an ideal fire base would include protection against direct and indirect fire, in-depth defense against ground attack, durability when exposed to harsh weather, high standards of sanitation

and troop comfort, ease of resupply, and facilities for recreation for the security troops.

In late February 1972, the 3d Brigade (Separate), 1st Cavalry Division (Airmobile), conducting the defense of the Long Binh, Saigon, Bien Hoa Complex, set about the task of constructing fixed fire bases to idealized specifications.

The Brigade had just been reduced in size from four maneuver battalions to three and was tactically disposed in an arc roughly northeast of Saigon. To accomplish his mission, the Brigade Commander, Brigadier General James F. Hamlet, established a series of six mutually supporting and highly defensible fire support bases to provide an artillery fan over the rocket

belt and its approaches. Under this umbrella of steel, the highly mobile Cavalry companies conducted airmobile operations that kept the NVA rocketeers off-balance and in constant turmoil.

The keys to this operational technique were the fire support bases, which served as forward artillery positions, operations centers, and R&R sites for the infantry companies rotating in and out of the "bush."

Bunker Hill was one of these firebases. Located on a squat laterite hill, 17 miles northeast of Saigon, it was the home of the 1st Battalion, 12th Cavalry, commanded by Lieutenant Colonel W. S. Tyson,

The firebase construction team that cut the initial swath through the scrubby underbrush covering the hill was an amalgamation of the best engineering skills then available. Although the 3d Platoon, 501st Engineer Company had overall responsibility for the construction, earth moving equipment from the 557th Light Equipment Company and a verticle construction platoon from the 92nd Engineer Battalion were included in the task force.

The 557th had only 15 operational days remaining prior to standdown, so a crash program of earth moving was inaugurated. An average of four Caterpillar 830's hauled their 20 cubic yard loads from 7:30 a.m. to 5:30 p.m. hours for the next two weeks. For a three day period, four 'yellowbird' 10 ton dump trucks and a "Hough" six cubic yard loader from the 92nd Engineer Battalion also participated in the earth moving effort. The equipment began by stripping the scrub vegetation and forming the familiar triangular shape of another FIRST TEAM fire base. The 830's did the bulk of the heavy earth moving. The 'yellowbirds' were used in the corners and on the berm in places that were not suitable for the huge 830's.

The overall construction of the firebase was controlled by an initial survey and level run on the first day. The 830's dug the slots for living and fighting positions under the berm. D7 dozers were used to dig the slots for the tactical operations center, mess hall, ammunition storage area, S4 area, medical bunker, base defense/fire direction center and post exchange bunker.

The vertical construction Platoon built the framework for the Tactical Operations Center and the Mess Hall. They also supervised local nationals pouring the concrete floors for both structures.

The TOC was dug eight feet into the ground and covered by M8A1 matting and the equivalent of seven layers of sandbags. Its overall dimensions were twenty feet by eighty feet. The TOC consisted of twelve inch by sixteen inch footers and columns with four inch by twelve inch caps and twenty-four inch wide flange beam ceiling joints. M8A1 matting sides with four

inch by twelve inch lateral bracing were used. The operations center was located in this building as well as the briefing room, offices, and living quarters of the Commanding Officer, Command Sergeant Major, the operations officer, and the ARVN liaison officer. An underground tunnel connected the TOC directly to the base defense/FDC bunker.

The Base Defense/FDC bunker, constructed of mempa's and conex containers, contained the artillery fire direction center, the mortar fire direction center, the base defense operations center, the base switchboard, the VHF facility and sufficient living space for personnel required to man the bunker. The combination of TOC and base defense/FDC enhanced the command and control of the firebase under all conditions.

The 105 mm Howitzers were placed on a 200 foot equilateral triangular pad raised six feet to provide direct fire over the berm.

The solid triangular pad had been laid by the 830's. A D7 with a sheepsfoot roller and a water truck provided compaction. This pad was more durable than the individual circular pads used previously. The 155 mm Howitzer pad was raised only one foot to facilitate drainage. The mortars were separated with two tubes in a corner by themselves and one in the corner with the 155's. This was done because of the possibility of a short round when firing directly over the firebase and because of falling canisters when illumination rounds were used.

All tubes were set in their own revetted positions with their basic load safely stored under the heavy cover of sandbagged bunkers. The individual mortar pits were sandbagged to a height necessary to provide cover for the crews against fragmentation. Slots were left in the parapet so as not to interfere with the use of aiming stakes or sighting devices.

The mess hall consisted of a 40-foot by 20-foot storage area and two 10-foot by 20-foot serving areas. By using a system of vents (M8A1 matting and 72 inch culverts) in the roof, the mess hall was well ventilated even though it was eight feet under ground. Troops were not exposed to hostile fire while they were getting their meals. Eating areas were dispersed throughout the firebase to avoid large concentrations of troops during regularly scheduled mealtimes.

The ASP was a 60-foot by 20-foot structure where 12 inch by 12 inch columns eight feet high were used. The roof was supported by 10 inch wide flange beams covering eight-foot open spans with eight inch by eight inch stringers on 30 inch centers.

The entire structure was covered by M8A1 matting. The two entrances were located on opposite ends of the building. The main entrance was a 10 foot wide

ramp with a minimum six foot height, running 30 feet to serve as a mule entrance. The secondary entrance was a combination of 72 inch culverts and eight inch by 12 inch side wall bents in the form of a ramp to serve as a walkway entrance. The floor was dirt and all storage was on wooden dunnage. The overhead cover was a minimum of three feet of soil on the M8A1 matting roof. The entire structure was water proofed with plastic, and the roof had cement coated with peneprime.

The 501st Engineers were responsible for construction of the structures under the berm. The basic design incorporated the majority of the living areas and fighting positions as part of the berm in order to take full advantage of the protection provided by the eight foot high triangular earth berm. A second advantage gained was a significant saving of space normally taken by troop living areas around the interior of the base. When areas must be provided for a minimum of three 105mm Howitzers, two 155mm Howitzers, and three 81mm mortars, and their accompanying fire control centers, interior space becomes extremely critical, especially, in the corners. Conex containers were used as living bunkers and had to be positioned in the trenches prior to the finalization of the berm.

Modular design was incorporated whenever possible to reduce supervision requirements and simplify the task of the individual squads. By letting one squad concentrate on one type of structure, time was saved and high quality work insured. Corner bunkers, corner positions and supplementary positions were each standardized and constructed alike. The modular concept and the diligent efforts of the 501st Engineers enabled the combat engineers to complete their berm work prior to the loss of the 557th's equipment.

The modular building practice was continued throughout the base. The TOC, Mess Hall, and ASP were all built with the same basic framework design. The remainder of the buildings utilized a four foot hallway with conexes facing each other. In all, there were 38 entrances with one set of stairs, and 14 entrances with two sets of stairs. Modular design was again used to simplicity and speed construction.

The living bunkers were ideal for the individual infantryman. The conexes, with doors removed, provided comfortable, dry places to live during heavy monsoon rains. This was a very important feature to a "grunt" who had been "beating the bush" in mud and rain. The bunkers also were ventilated by a 20-inch opening on the inside wall. Safety was excellent with five feet of dirt cover overhead and a minimum of five feet of dirt between the rear of each conex and the face of the berm. Comfort became an individual endeavor and troop ingenuity appeared almost immediately. Floors

were painted, walls paneled and rugs added as personal touches to the conex quarters. The conexes were very adequate for two people to share. Malaria control was enforced by screening all quarters at the doors and windows. The fronts of individual conexes were screened as an added precaution.

Above the bunkers was the berm, reaching an overall height of eight feet. A row of concertina was on the apex. At the outside base of the berm was a row of triple standard concertina. Against the concertina a 10 foot wide stretch of tanglefoot was constructed. The 35 meter anti-sapper wire was a double apron fence with concertina crushed under the apron and backed by a second triple standard concertina barrier. The 100 meter anti-RPG fence was triple standard concertina. The wire obstacles were reinforced by claymore mines and fougasse (a combination of napalm and C-4 demolitions). Huesch flares were located at each corner and along the sides to mark the firebase perimeter for close air support. Numerous trip flares were incorporated within the outer wire.

The tactical wire was directly supported by seven fighting positions on each side. The design of the fighting positions maximized the principle of primary and supplemental bunkers and insured that the two personnel assigned to each position were not tasked with an area of responsibility greater than they could effectively cover. The main strength of a triangle lies in the corners, and by advancing the corner position out from each apex, mutually observed and supported fields of fire were gained between the corner bunkers. Conversely, the singular vulnerability of a triangle is that the extended corner may also be attacked and possibly neutralized from three different sides—only one of which may be the side facing the principle direction of ground attack. To reduce this vulnerability, the corners were constructed as a three unity module.

The center conex was oriented with the apex, and the units to its left and right were positioned to provide coverage both to the individual position's front and exposed flank. The conexes were set into the ground four feet, the space between them was back-filled, and the entire position was faced with four layers of sandbags and capped with a minimum of three feet of laterite and peneprime overhead cover. The supplemental positions were located immediately to the flanks of the primary and were constructed flush with the face of the berm so as not interfere with observation or fields of fire from the corner positions.

Above each corner, and connected by means of a ladder down into the position, was a 15-foot observation tower. The towers were eight feet on a side, faced and roofed with M8A1 matting and sandbags. They provided an uninterrupted view of all approaches to



Fire Support Base Bunker Hill is typical of the triangular firebases constructed by the 3d Brigade (Separate), 1st Cavalry Division (Airmobile).



The underground tactical operations center served as nerve center for combat operations of the 1st Battalion, 12th Cavalry during the period February thru June 1972.



In the safety of the underground FDC, artillerymen plotted fire missions. The FDC was connected to the TOC by an underground tunnel.

Wire, lights, and tanglefoot formed a portion of the perimeter defenses at FSB Bunker Hill. These were augmented with trip flares, claymore mines and fougasse.



BUNKER HILL: FORTRESS



The elevated 105 artillery pad provided good stabilization and a capability for direct fire across the eight foot high firebase berm.



This medical bunker is typical of the interior bunkers at the fire support base. Waterproofing was provided by roofing felt, soil cement, peneprime and treated sandbags.



The water from this purification system was pumped to a sixteen foot tower to provide central distribution for showers, drinking, mess hall and other uses.



The food preparation, storage, and serving areas were also underground. The gabled roofs cover the culvert and PSP ventilation system.

The outdoor stage served as movie theater, USO stage and briefing area. Dressing rooms are at left.



IN THE SUN

the base. The roofs provided an employment site for organic radar equipment. Because living space was contiguous to the fighting bunkers, troops could move from their quarters to assigned fighting positions without having to move across the exposed interior of the base.

The combination of bunkers and towers allowed the nightly guard commitment to consist of 12 to 15 men on watch during a given four, depending on cloud cover, moonlight, etc., and one man on a walking post inside the base. Under conditions of RED ALERT, 48 men were required to man the fighting positions.

For the relaxation of the troops, three temporary volleyball courts were erected. A permanent basketball/volleyball court was planned. The goals could be folded down and the posts removed so that the concrete slab could be used as an emergency medivac pad. Horseshoe pits appeared and football was played in the several open areas.

Bunker Hill served as a comfortable and efficient operating base for the 1st Battalion, 12th Cavalry until their standdown on 17 June 1972. There were many engineering lessons learned during the construction of this base. Some technical considerations and special engineering considerations inherent in underground construction in Military Region III are worthy of note—

- Salvage conexes are ideal for underground construction. They are strong, watertight and convenient. Additional strength is obtained by turning a conex up-side-down since the bottom is better constructed than the top. An ideal salvage conex is one that is in perfect watertight condition, but with a damaged door. If one attempts to use conexes with major faults such as bad skids or rust-outs an additional well planned program of bracing and waterproofing must be added to the basic work schedule. The over-all work control quality of base construction is greatly enhanced by careful inspection and selection of salvaged conexes.

- Backfilling is a most delicate operation when using conexes. A medium-sized boulder can send a conex skating for six or seven feet if it is allowed to drop against the side of the conex with uncontrolled velocity.

- The PSP roof should have an overhang of at least one foot. However, sandbagging should come flush to the outer edge of the PSP. If the sandbags are placed back from the edge of the overhang, water has a tendency to pool on the PSP and then work its way back into the bunker. This can be prevented in part by sloping the roof to the outside, but there is always some uneven settlement which will allow the water to run the wrong way.

- Unless there is time to run a soil analysis and arrive at an acceptable spread footer design, one should

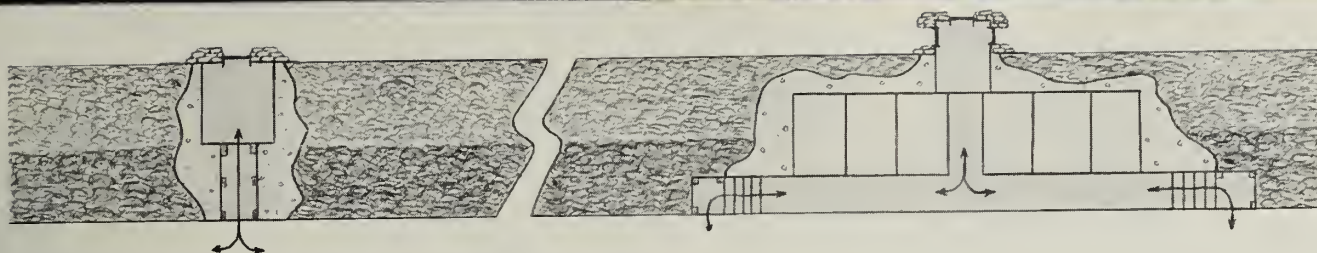
always use a continuous footer. This will retard differential settlement to a great degree.

- If lumber is scarce, a planned utilization of bracing should be undertaken prior to backfilling of all major construction. If priority lists completion of the TOC first, lumber from the mess hall BOM should be used to add extra bracing to the TOC prior to its backfill. Backfill pressures at eight feet can run as high as 2000 psi. The most feasible solution was to use a Case 450 mini dozer and let the backfill material slide slowly down into position. Tamping was unnecessary due to the jetting effect of the rains.

- Around the living bunkers it was found that the best waterproofing was twelve foot wide rolls of plastic. One hundred foot lengths significantly reduced the number of seams. All seams were sealed using peneprime to glue the plastic together. Gluing vertical seams was an extremely dirty task. So reducing the number of seams benefitted the work force as well as improved the watertightness.

- The PSP roof was first covered by tar paper, then sealed with a coating of peneprime. The most constant problem encountered was voids along the edges of the conexes where the PSP and conex roof failed to match up properly. In these rough areas sandbags or dirt were used to level out the irregular surfaces. If the extra work wasn't done, then holes from either backfill or people walking were made into the otherwise watertight seal. The backfill of loose soil was then molded into a gable effect in order to enhance water runoff. The numerous people walking on or shoveling the loose soil yielded acceptable compaction. The soil was then stabilized using portland cement handraked into the soil. The cement was watered and allowed to set. A coating of peneprime was placed over the cement. A layer of peneprime-sealed, plastic was added. Peneprimed sandbags were used as a final cover. The sandbags must be the cloth type since the fiberglass type disintegrate rapidly when peneprime is placed on them.

- A road design which minimizes the number of culverts and good landscaping are the key to good firebase drainage. Culverts are a constant problem because large vehicles crush the ends of them and foreign matter continually clogs them. Culverts that were found necessary were designed to maintain a minimum flow of two feet per second or more where possible. The self cleaning properties of this velocity made the drainage system work efficiently. Where slope factors were unfavorable, open culverts were utilized to facilitate cleaning. A very essential part of keeping the culverts working is to protect their ends by some sort of culvert marker. This was accomplished by combining 155 canisters and 2x4s. A simple design such as this not only keeps the culverts open, but adds to



the esthetic value of the firebase. The cannisters were mounted on U shaped pickets so if hit by a vehicle they were simply knocked down. They could also be removed for road spraying and then easily replaced. This eliminated a constant need for repainting.

- An acetylene set is the workhorse of a conex firebase. Doors must be removed, windows cut, passageways fabricated, firing ports cut, PSP trimmed, and many other handyman jobs done. There are defecation barrels, trash barrels and shower barrels to be cut. Pipelines to the showers must be braised, and barrels to be used as hand wash facilities must have vent/filling holes cut.

- To facilitate air traffic control and aid the pathfinders in their duties, the log pad, combat assault pad and VP pad were centrally located on one side of the firebase. This allowed the pathfinders to utilize one of the corner observation towers thus eliminating the need for an additional tower. The 35 meter fence was moved out to 50 meters to allow plenty of flying space for the combat assault and VIP pads and keep the troops inside the wire during combat assault operations. The log pad was located outside the 35 meter fence but inside the 100 meter fence. Locating the pads on one side of the firebase enabled the mess hall to be located as far as possible from the pads. The aid station was positioned close to the entrance to the base and convenient to the helicopter pads.

- The water distribution system was centralized. Showers were located where water runoff would travel the shortest distance to the outside of the berm. This minimized standing water from showers. The water point pumped to one main 16 foot high tower. Gravity fed distribution led to the showers, drinking water tanks, mess hall, and mess hall wash rack area. The need for continuous truck hauling on the firebase was minimized. The only remaining water haul was to fill the 55 gallon washing barrels that were maintained in the vicinity of the living and latrine areas for sanitation purposes. The distribution method incorporated at Bunker Hill was similar to a standard high rise water treatment plant. Instead of a heavy duty high lift pump, a small 50 gallon per minute pump and a two and one-half ton utility vehicle with two 600 gallon pods were used. Water was carried from the river to the firebase where it was treated and filtered. The security element was required only two hours each day. Water runs times could also be altered to minimize the enemy's chances for ambush.

- If at all possible, the latrines and showers should be prefabricated so that they can be set up and used early in the construction phase. They should be built with durable skids so that frequent movement will not ruin them.

- A grease trap should be installed in conjunction with the wash rack just inside the berm. This will aid in the sanitation program, since there will be no garbage inside the berm. A sanitary land fill should also be put into operation at some distance from the firebase.

- In the event the nine mile road from Bien Hoa to Bunker Hill was cut by the enemy or weather, and air traffic was grounded, storage facilities to sustain the base for up to five days were provided. Each fighting position contained a pre-positioned basic load of M79, M60, and 5.62 ammunition in addition to that stored in the ASP. All artillery pieces had their basic load stored on site in well sandbagged bunkers. The mess hall had 800 square feet of pure storage area, and the S4 had 1,200 square feet of storage. The medics used one complete conex for storage. Water tanks with 7,200 gallons of storage capacity were also located on the base.

Construction of a fire support base like Bunker Hill requires a significant investment in time, effort, and materials, but the result of the 35 day effort was a highly defensible, self-sustained, and efficient battalion-sized operating base.

While Bunker Hill will probably prove to be the last of the major United States fire bases constructed in South Vietnam, the lessons learned in its construction still have lasting validity. ☺

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DYNAMIC

Equation for Imp

Major Don W. Barber

Quality Control-Product Improvement! This rather simplistic equation is universally applicable to the production of any item. While the product of the military training and combat developments system is unique, nonetheless, its production is governed by the parameters of the same product improvement equation. The achievement of improved readiness, which depends upon both better training and viable combat developments, is contingent upon a thorough understanding of the parameters of the equation.

In an effort to make true readiness a reality for the Army's engineer, the USAES has embarked on an in-depth program for the quality control of its products. This program centers on one of the most important and unfortunately most often forgotten elements of the communication process—feedback. Our products are equipment, materials, organizations, doctrinal and training literature, training aids, and trained personnel. When properly prepared and built into a common system—military engineering—these products are capable of performing their readiness mission in superlative fashion. The caveat "properly prepared," is the fly in the ointment. Up to now the gauge for measuring the value of our products has been somewhat peremptory and at best cursory. In the past the USAES has relied upon mailed questionnaires to graduates of school courses and an occasional comment on a field manual by a few interested persons to evaluate our products. Responses to mailed questionnaires have been poor with less than a 30% return rate. Thus the data used for combat and training development was sketchy at best. Such a cavalier approach can no longer be tolerated. After an in-depth study, a system for data collection—The Field Feedback System—was established. It consists of the following elements: field visitation; debriefing of USAES staff and faculty; debriefing of student personnel; MOS test proficiency data; mailed questionnaires, to USAES graduates; and research feedback. Each of these elements is discussed below—

- **Field Visitation Program.** This program provides for annual visits to units which use the USAES mission products. These visits will be accomplished by a rela-

tively small team (4-5 personnel) of representative specialists who will sample Army-wide users of the school's products with questionnaires and interviews. Their intention is to gather data on which to evaluate the worth of these products.

- **Debriefing of Assigned Personnel.** This data collection mode formalizes a previous informal practice by using the basic collection devices associated with the Field Visitation Program. It will assure the background and experience that an individual brings to the school on his assignment will be considered in the assessment of the USAES mission products. The mechanism for data collection is under development. Implementation is scheduled for 3rd Quarter FY 74.

- **Debriefing of Student Personnel.** This mode will insure that the experience and background of selected students are tapped in the collection of appropriate field feedback data. A pilot program was conducted with the current EOAC class.

- **MOS Proficiency Test Data.** The reports generated by the U. S. Army Enlisted Evaluation Center provide a valuable source of feedback and will be emphasized in the future implementation of the total Field Feedback Survey System. The data collection device is under development.

- **Mailed Graduate Questionnaire.** Traditionally this data mode had been the sole collection device. Under the new Field Feedback concept, the mailed questionnaire will be a stand-by mode for use only as a supplement for specified reasons.

- **Research Feedback.** This mode uses the feedback data of other service schools having significant blocks of Engineer-related instruction in their curricula. Once implemented, the analysis of such feedback will complement the data received through other modes.

The major collection vehicle in the Feedback System will be the Field Visitation Program. For it is through direct, face-to-face communication that the most reliable data to be used both in the systems engineering of USAES curricula and training developments, and in combat developments will be accrued.

Systems engineering is a term that has recently

TRAINING

oved Readiness

Major Matthew J. Jones, Jr.

entered the lexicon of the service school staffs and faculties. In essence, it is an elaboration of the classic problem solving scheme—identify the problem, determine alternative solutions, and reduce or eliminate the problem through the application of the optimum feasible alternative solution. Systems engineering is being applied to all USAES courses and training developments. It consists of elements shown in Figure 1.

In training or in combat developments, quality control is fundamental to product improvement. Quality control cannot be effected without feedback. Therefore, feedback is essential to product improvement. It must be a continuous process in order to keep pace with the dynamic training and combat development environment that surrounds the Army engineer in the field.

What Has Been Done? In order to obtain more reliable data from a more representative sample of product users, the USAES proposed the Field Feedback System. With concept approval from CONARC and OCE, the USAES fielded a pilot Field Visitation Program to survey 19 engineer units in Europe during March 1973.

The Field Visitation Team (composed of 5 personnel) visited two combat engineer brigade headquarters, an engineer group headquarters, seven engineer battalions, and five separate engineer companies. The team survey included questions pertaining to: MOS tasks for 24 of the 164 engineer skills; equipment usage; training literature usage; non-resident (correspondence) subcourse usage; a unit training survey about training problems (a follow-on to the Engineer Dynamic Training Survey of January 1972) and missions assigned to units; proposed assault engineer functions; and revision to the Career Management Fields (CMF) for engineer soldiers. Overall, the return rate for questionnaires was approximately 68%. The other 32% did not respond for various reasons, viz, personnel not available at home station, the survey was too difficult or too long, shortages of surveyed MOS's, and five of the 1200 personnel surveyed just didn't give a damn.

While the data from USAREUR cannot be con-

sidered as totally representative of the training and combat development universe, several clues evolved on how to improve the visitation program, i.e., what questions to ask, how to ask them, and how to manage the volume of data gathered. This visit proved conclusively that the field has many lessons learned that need to be passed on and that these lessons are more likely to be transmitted to a person through direct communication than via a piece of paper to a faceless, nameless office an infinity away. An initial analysis has been made of the unit training portion and certain of the individual training portions of the USAREUR Field Visit. The results are summarized below:

- **Unit Training.** There were 245 Unit Training questionnaires sent to USAREUR. Approximately 60% (144) were returned, 51% (74) enlisted and 49% (70) officer. By unit, respondents were about equally divided between engineer combat and construction units. Highlights of the findings were:

- Drug/alcohol abuse and shortage of key MOS's were the major personnel obstacles impacting on training.

- It is also significant that enlisted personnel reported unit morale and discipline as verging on being a major problem.

- Significantly, neither the shortage of TOE, nor inoperative TOE, equipment was reported as creating a serious problem affecting training although combat units indicated a more severe problem (26%—major problem) than did construction units (13%—major problem).

- Demolition areas and quarry/borrow sites were reported in short supply with combat units having major problems in demolition training area availability (46%—major problem).

- Practice/inert mine availability was seriously degrading realistic mine-countermining training of combat engineer units.

- General construction materials such as plumbing and electrical supplies, and lumber were in short supply.

- Twenty-five percent indicated that local safety/environmental restrictions were major problems af-

fecting training. This response was primarily keyed to the range restriction for demolitions (maximum of 40 pounds per shot) and not being allowed to cut native timber.

—Many personnel indicated little or no knowledge of their unit Army Training Program and hence had no real concept of what to train or how to train —Only 23% had read ATP 5-35T, but of those who had 69% indicated that it was an improvement over the existing ATP.

—There was a wide divergence of opinion between officer and enlisted personnel regarding the value of the ATT'S/ORTT'S received in the past year. The officers believed that the ATT's were not a good test of mission, staff actions, logistics, and materiel readiness while the enlisted personnel, in the main, felt that the ATT's were excellent.

—There was little usage of non-MOS Army Subject Schedules.

—Over 33% of those responding had never participated in a test or exercise at the company, platoon, or squad level. Approximately 40% had never participated in a combined arms FTX and over 70% had never participated in engineer airmobile training.

—The training support from the next higher headquarters—scheduling of training facilities, guidance, etc—was rated as poor to fair.

—Approximately 36% indicated that mandatory subjects are a major impediment to unit training.

—On the average about 27 days/year were spent in field training near home station, 50 days in field training away from home station, and 15 nights in field training. Of particular significance, however, was the low average percentage of personnel available for such field training (over 43% indicated that only 60-75% of the troops were present for field training). Additionally, the average number of days spent in the field was indicated by construction unit project TDY and does not accurately reflect the actual time spent in the field by combat engineer units.

—Only 37% had heard of the Engineer Dynamic Training Council. A higher percentage 44%, had read the Dynamic Training Articles in *the engineer*. Magazine.

• Individual Training. The individual training surveys analyzed to-date pertain to combat and construction officer questionnaires. The objectives of these surveys were to: validate job task inventories for the 1328, 1330, 1331, and 1342 officer MOS's; determine on-the-job proficiency of USAES officer graduates in the above MOS's; assess the effectiveness of USAES teaching methods/media as a step

in quality control of course design; obtain reactions to published training literature for the purpose of improving its utility to the user; and assess the effectiveness of USAES correspondence courses. Sixty-three combat engineer and 24 construction engineer officers responded to the questionnaire comprising a 66% and 61.5% return rate, respectively.

Figures 2 and 3 depict the tasks rated most difficult. Note in Figure 2 that only one task, No. 26, involved a knowledge of combat engineer expertise. Both Figures 2 and 3 show a great deal of agreement in tasks found difficult and their relative order of priority.

Most tasks found difficult were those that fall in the general area of *Leadership*. The preponderance of the remainder of the tasks in both Figures 2 and 3 pertain to deficiencies in *Training Management*.

Figures 4 and 5 show the most frequently done tasks and average frequency by functional area for combat engineer officers. These data show that combat engineer officers in USAREUR are spending relatively little time on combat engineer related tasks. This finding correlates with the data in Figure 2 and partially explains the dearth of combat engineer tasks found to be most difficult, since the level of difficulty will vary with the scope of tasks performed.

Figures 6 and 7 show the most frequently done tasks and average frequency by functional area for construction engineer officers. An analysis of these data show most construction tasks are vertical in nature and the preponderance were in the building renovation and self help categories. It appears that construction engineers in USAREUR do not extensively work on large scale, MCA type, construction projects. Other findings included:

—A suggested increase in EOBC instruction for company administration.

—A general acceptance of the adequacy of existing training aids and publications.

—Satisfaction with the technical content of USAES correspondence courses.

Reserve Components Feedback

The Field Visitation Program is a phased program. Phase I consisted of the pilot USAREUR study. Phase II will consist of visits to both Active Army and Reserve Component engineer units. In view of the increased emphasis being accorded the Reserve Components, the liaison subprogram of the USAES Expanded Reserve Component Support Program was seized on as an interim measure for soliciting feedback from the Reserve Components until phase II is initiated. The visiting team has been composed of officer representatives of the two Deputy Commandants of the USAES to insure full coverage of the two major aspects of

the USAES mission, viz., training and education, and combat and training developments. Units visited to-date include the 412th ENCOM (USAR), 416th ENCOM (USAR), 411th Engineer Brigade (USAR), 16th Engineer Brigade (OHARNG), and 168th Engineer Brigade (MSARNG). The feedback through this team has presented a generally consistent picture of the status of training within Reserve Component Engineer Units. This picture reveals the following:

—The morale and *esprit de corps* is high within those units visited.

—A positive desire to improve training was abundantly evident in all units visited.

—The constraints which act upon the Reserve Components are in many cases different from those which drive the Active Army with time being the principal constraint.

—By and large the Active Army is uninformed, or worse mis-informed, as to the Reserve Components.

—Training of construction units is progressing extremely well through a variety of site/installation and domestic action construction projects.

—Conversely, the over-commitment of combat engineer units to site/installation and domestic action projects is severely degrading combat engineer dynamic mission training.

—The lack of weekend IDT (Inactive Duty Training) sites to conduct realistic mission training is also severely degrading training, particularly for combat engineer units.

—The R.C. units need more assets in the way of training funds and/or training materiel, both consumable and non-consumable, to make training more dynamic.

—Training assistance can be met in many cases from resources close at hand such as increased use of USAR Schools, sharing of expertise and/or equipment among units in close proximity to one another both USAR and ARNGUS, and increased use of training institutions both public and private.

—Equipment availability varies among the units with steady improvement in program.

—There was an intense interest in the new ATP/ATT/N-MOS ASUBJSCD development using the systems engineering approach,—objective/task completion rather than the cyclic BUT/AUT approach.

—The R.C. units were most receptive to the Field Feedback Visitation Program and, indeed, anxious to participate and be given the opportunity to have a voice in the formulation of programs governing their training.

—Although there have been numerous obvious successes in improved/dynamic training, commanders recognize that much more needs to be done. A

principal concern of the commanders and their staffs was the devising of some motivation/incentive which would stimulate interest in training. Personnel need to be stimulated to the point where they are eager to participate in and, indeed, look forward to realistic, hands-on, mission training during weekend MUTA (Multiple Unit Training Assemblies).

—Those units that have received additional paid drill time for training preparation have experienced a greater level of improved training than those units without such authorization.

—The **engineer magazine** is widely recognized as a useful media to share the wealth of training innovations being developed.

—A need is seen for larger unit exercises and development of CPX's to train and test major engineer headquarters.

In conjunction with the evaluation of selected Reserve Component unit annual training, a testing of questionnaires to be used for the Field Visitation Program during Phase II is being conducted.

What is Being Done Now? The USAES is currently analyzing the remainder of the myriad of data collected in Europe for MOS's. The major results from feedback received to date are being used for development of USAES and USATC-Engineer/Fort Leonard Wood curricula, MOS ASUBJSCD's, ATP's/ATT's/N-MOS ASUBJSCD's, and training literature such as the one stop MOS study guides.

What is Planned?

—Expansion of the Engineer School team visits, down to and including separate engineer groups.

—Implementation of Phase II of Field Visitation Program with visits by the selected specialist team to Reserve Component and Active Army units in the field.

Field Feedback is the principal element of the engineer training community quality control effort. It will be the major driving force in the continuing re-evaluation and updating of USAES products.

All commanders and staffs are urged to keep the USAES in their communication cycle as we try to keep you in ours. For it is only through dialogue (read that dual feedback) that Quality Control = Product Improvement. **E**

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Figure 2

Most Difficult Tasks - Combat Officers
Sample Size = 48

Task	# Diff	% Diff
1. Develop responsibility in subordinates	27	56%
2. Improve unit morale, esprit de corps, etc.	26	54%
3. Handle disruptive influences	25	52%
4. Motivate subordinates effectively	24	50%
5. Improve personal qualifications to be better leader	22	46%
6. Develop good human relations within unit	21	44%
7. Conduct lawful search/seizure	19	40%
8. Identify drug/alcohol abusers for disciplinary action	17	35%
9. Evaluate unit for morale, esprit, etc.	17	35%
10. Communicate effectively	17	35%
11. Choose proper style of leadership	16	33%
12. Identify peer group pressure within unit	16	33%
13. Initiate elimination procedures	16	33%
14. Prepare enlisted efficiency report	15	31%
15. Use AR 635-206 and AR 635-212	14	29%
16. Analyze time and resources for training	13	27%
17. Prepare unit training schedule	13	27%
18. Counsel subordinates	13	27%
19. Enforce supply economy	13	27%
20. Advise subordinates on service benefits	12	25%
21. Interpret pay voucher	11	23%
22. Evaluate unit training requirements	11	23%
23. Supervise unit athletics	11	23%
24. Check morning report for accuracy	11	23%
25. Select training methods	11	23%
26. Prepare demo target recon report/target folder	10	21%
27. Develop unit training objectives	10	21%
28. Prepare unit training directives	10	21%
29. Support drug and alcohol abuse programs	10	21%
30. Coordinate operator testing/licensing	10	21%

Figure 1. Systems Engineering Process

		<u>Individual Training</u>	<u>Unit Training</u>
Problem Identification	Step 1	Job Analysis	Mission Analysis
	Step 2	Selecting Tasks for Training	Selecting Tasks for Training
	Step 3	Training Analysis	Task Analysis
Alternative Solutions Determination	Step 4	Developing Training Materials	ATP/ATT/N-MOS ASUBJSCD Development
	Step 5	Developing Evaluation Materials	
Optimum Solution Application	Step 6	Conduct of Training	Conduct of Training
	Step 7	Quality Control	Quality Control

Figure 3

Most Difficult Tasks - Construction Officers
Sample Size = 21

<u>Task</u>	<u># Diff</u>	<u>% Diff</u>
1. Develop responsibility in subordinates	11	52%
2. Develop good human relations within unit	9	43%
3. Improve personal qualities to be better leader	9	43%
4. Identify peer group pressures within unit	9	43%
5. Prepare enlisted efficiency report	9	43%
6. Conduct lawful search/seizure	8	38%
7. Improve unit morale, esprit de corps, etc.	8	38%
8. Estimate compaction equipment requirements	7	33%
9. Motivate subordinates effectively	7	33%
10. Handle disruptive influences	7	33%
11. Initiate recommendations for awards/decorations	7	33%
12. Advise subordinates on service benefits	6	29%
13. Perform activities in accordance w/professional ethics	6	29%
14. Evaluate unit training requirements	6	29%
15. Establish effective work relations w/subordinates	6	29%
16. Establish effective work relations w/superiors	6	29%
17. Direct EM to proper channel for assistance	6	29%
18. Identify alcohol and drug abusers for disciplinary action	5	24%
19. Plan vertical construction	5	24%
20. Evaluate suitability of materials available	5	24%
21. Analyze area being drained	5	24%
22. Select training methods (incl dynamic training)	5	24%
23. Instruct a class.	5	24%
24. Counsel subordinates	5	24%
25. Evaluate unit for morale, esprit, etc.	5	24%
26. Select routes for unit movements	5	24%
27. Check unit orders	5	24%

Figure 4

Most Frequently Done Tasks - Combat Officers
Sample Size = 48

<u>Task</u>	<u># Done</u>	<u>% Done</u>
1. Prepare enlisted efficiency report	43	89%
2. Direct EM to proper channel for assistance	43	89%
3. Recommend individuals for promotion/demotion	42	87%
4. Land Navigate	39	81%
5. Perform duties as class A agent	39	81%
6. Maintain personal physical fitness	37	77%
7. Approve leave or pass requests	36	75%
8. Use/supervise use of M16A1/M203	35	73%
9. Use protective mask	35	73%
10. Use tactical radio equipment	35	73%
11. Inspect weapons	34	71%
12. Use and Supervise use of .45 cal pistol	32	67%
13. Supervise unit athletics	30	62%
14. Serve as member of unit promotion board	30	62%
15. Check morning report for accuracy	29	60%
16. Check duty roster	29	60%
17. Enforce supply economy	29	60%
18. Supervise unit physical training program	28	58%
19. Supervise unit movements	28	58%
20. Check military correspondence	28	58%
21. Perform unit mess sanitation insp	27	56%
22. Analyze transportation requirements	27	56%
23. Supervise use of equip operational rec	27	56%
24. Evaluate physical security	26	54%
25. Select transportation routes	26	54%
26. Perform duties of convoy/serial commander	26	54%
27. Inspect vehicles for proper loading	26	54%
28. Insure proper use phonetic alphabet	26	54%
29. Initiate recommendations for awards/decorations	26	54%
30. Supervise use of DA Form 2408-14	26	54%
31. Perform preventive maintenance operations	26	54%
32. Obtain mil geographic documents for opn	25	52%
33. Supervise use of dump trucks	25	52%
34. Analyze transportation routes	25	52%
35. Perform vehicle safety inspection	25	52%
36. Enforce authentication procedures	25	52%
37. Initiate elimination proceedings.	25	52%
38. Supervise use equip maint records	25	52%
39. Control platoon/company org maint	25	52%

Figure 5

Average Frequency by Functional Area - Combat Officers

<u>Section</u>	<u>Avg % Done</u>
1. Bridging	27%
2. Vertical Construction	19%
3. Horizontal Construction	6%
4. Utilities	4%
5. Geology and Quarrying	1%
6. Equipment Utilization	15%
7. Combat Construction Management	31%
8. Pipeline Construction	0%
9. Engineer Reconnaissance	31%
10. Explosives and Demolition	25%
11. Mine/Countermin Warfare	15%
12. Field Fortifications	8%
13. Camouflage	12%
14. Concrete	12%
15. Atomic Demolition Munitions	4%
16. Assault River Crossings	19%
17. Engineer Combat Support	23%
18. Rigging	4%
19. Environmental Considerations	10%

Figure 6

Most Frequently Done Tasks - Construction Officers
Sample Size = 21

<u>Task</u>	<u># Done</u>	<u>% Done</u>
1. Estimate construction equipment requirements	17	81%
2. Maintain personal physical fitness	17	81%
3. Recommend individuals for promotion/demotion	17	81%
4. Direct EM to proper channel for assistance	17	81%
5. Prepare enlisted efficiency report	16	76%
6. Evaluate suitability of materials available	15	71%
7. Initiate recommendations for awards/decorations	15	71%
8. Analyze construction directive	15	71%
9. Conduct investigation of work site	15	71%
10. Develop activities list	15	71%
11. Estimate resource requirements for an activity	15	71%
12. Estimate material requirements for an activity	15	71%
13. Estimate equipment requirements for an activity	15	71%
14. Estimate manpower requirements for an activity	15	71%
15. Estimate duration of an activity	15	71%
16. Estimate project duration	15	71%
17. Prepare construction schedule	15	71%
18. Revise construction schedule	15	71%
19. Use construction schedule	15	71%
20. Evaluate const site (subdiv/drng/eartwk)	14	67%

21.	Interpret specification/construction drawings	14	67%
22.	Inspect building construction	14	67%
23.	Estimate dump truck requirements	14	67%
24.	Prepare logic network	14	67%
25.	Approve leave or pass requests	14	67%
26.	Plan vertical construction	13	62%
27.	Plan site preparation	13	62%
28.	Inspect masonry construction	13	62%
29.	Supervise use of TOE construction tools	13	62%
30.	Plan renovations and remodeling	13	62%
31.	Inspect renovations and remodeling	13	62%
32.	Perform duties as class A agent	13	62%
33.	Supervise vertical construction	12	57%
34.	Supervise placement of concrete forms	12	57%
35.	Supervise renovations and remodeling	12	57%
36.	Prepare quality control plan	12	57%
37.	Implement quality control plan	12	57%
38.	Plan unit movements	12	57%
39.	Analyze transportation requirements	12	57%
40.	Allocate transportation assets	12	57%
41.	Plan masonry construction	11	52%
42.	Supervise placing/finishing/curing concrete	11	52%
43.	Conduct small scale renovation and remodeling	11	52%
44.	Check renovation/remodeling of building	11	52%
45.	Estimate scoop loader requirements	11	52%
46.	Administer physical proficiency tests	11	52%
47.	Use/supervise use of .45 cal pistol	11	52%

Figure 7

Average Frequency by Functional Area - Construction Officers
Sample Size = 21

<u>Section</u>	<u>Avg % Done</u>
1. Bridging	5%
2. Vertical Construction	40%
3. Horizontal Construction	10%
4. Utilities	10%
5. Geology and Quarrying	1%
6. Equipment Utilization	19%
7. Construction Management	71%
8. Pipeline Construction	0%
9. Engineer Reconnaissance	5%
10. Explosives and Demolitions	4%
11. Mine/Countermin Warfare	3%
12. Field Fortifications	1%
13. Camouflage	5%
14. Concrete	7%
15. Atomic Demolition Munitions	0%
16. Assault River Crossings	0%
17. Engineer Combat Support	5%
18. Rigging	1%
19. Environmental Considerations	5%
20. Soils Engineering	5%

YOU'LL GET A BANG OUT'A THIS

Sergeant First Class Charles T. Lewis

In ancient times, the term "explosives" meant only one thing: black powder, a mixture of potassium nitrate, sulfur, and charcoal. It was Roger Bacon who, in 1249, first published the formula to save himself from an accusation of witchcraft.

Of course, black powder continues to survive to this day but the commercial production of this first generation explosive by civilian manufacturers has had a rapid decline in recent years. The U.S. Army is currently the greatest single consumer of black powder, and during 1967 and 1968 the Army procurement was more than 4,000,000 pounds per year, and about 1,500,000 pounds in 1969, and about 800,000 in 1970.

The "boom" also has faded from the business of manufacturing and using dynamite a long and faithful workhorse for both civilian and military engineers. The DuPont Corporation, the giant of the industry, has closed down all but two of its dynamite manufacturing plants and the number of facilities owned and operated by other companies that remain so engaged has, in just the past 12 years, gone from 36 to only 14. Estimates are that dynamite will drop to five percent of the explosives market by 1890.

With the apparent passage of an explosive that has done a "bang-up" job for so many years, one must wonder what factors contribute to its demise. Safety is a definite factor but sophistication in the state-of-the-art has resulted in blasting agents which can do a better job, more efficiently, and are 80 percent less expensive than dynamite. One example is ANFO (Ammonium Nitrate/Fuel Oil). ANFO, as of 1971, has "blown-up" to the 70 percent mark on the scale that measures the nation's explosive market. A cost of from four cents to six cents per pound makes ANFO very attractive for large scale production blasting and earthmoving.

A second example of a blasting agent that has rapidly

gained in popularity as a replacement for dynamite is an explosive closely related to ANFO called slurry. To comprehend fully the evolution of slurry explosives, one must start with the discovery that adding fuel oil to pelletized ammonium nitrate (fertilizer), called prills, resulted in the making of ANFO.

Unfortunately, ANFO is not without several drawbacks, including its low density and ability to attract and absorb moisture. Paradoxically, it was found that through the addition of water, with suitable stabilizing agents, and, if desired, gelling agents, most problems could be overcome. Hence, slurry. And, as a bonus, handling of the explosive is simplified. Water-based slurries or gels vary in consistency from a heavy paste of jelly to a solid rubbery mass, depending on the gelling agents used, the most common being a type of gum. Gelling agents serve to insure a homogeneous consistency and facilitate handling.

It can be only too obvious, even to the casual observer, that the recent introduction of ANFO and slurries has already revolutionized construction blasting with the advantages of economy, safety, varied application, compatibility with rock transmittal velocities, and rapid, voidless loading of holes. Unlike his civil counterpart, the military engineer is fortunate in that the conventional demolition-type explosives maintained in the Army's arsenal includes M-1 military dynamite, which because of the exclusion of nitro-glycerin in its make-up and its ready availability in the face of dwindling commercial dynamite sources, offers the user some of the advantages sought after, and obtained, from ANFO/Slurries. In a word, military dynamite, etc., provides a natural stepping-stone to that day in the future when ANFO/Slurries are in common usage by U.S. Army Engineers.

Just a little foresight allows one to visualize a mobile, pump-equipped, transit-mixer arriving at the construction Engineer Battalion's quarry, safely blending the slurry chemicals at the blast site to a variable, controlled density, and pumping it into a borehole all in a single, smooth operation.—Fire-In-The-Hole! 

Sergeant First Class Charles T. Lewis entered the Army in 1961 and has served with the 17th Engineer Battalion, 2d A.D.; 11th Engineer Battalion, Korea; 78th Engineer Battalion, Germany; and the 65th Engineer Battalion, 25th Infantry Division in Vietnam. His military education includes graduation from the Combat Engineer Noncommissioned Officer Course in Germany, the Engineer NCO Course and the Engineer NCO Advanced Course at Fort Belvoir, Virginia. The sergeant is currently assigned as the senior enlisted Instructor of the Demolition and Mine Warfare Division, U.S. Army Engineer School at Fort Belvoir.

MINE-COUNTER

Colonel V

Why can't the Army do a better job of training for mine-countermining (M/CM) operations? Is it because:

- Commanders are not concerned?
TRUE FALSE
- Of poor guidance from the Pentagon?
TRUE FALSE
- Of inadequate advice from Engineers?
TRUE FALSE
- M/CM doctrine is wrong?
TRUE FALSE

In my opinion, all are true. Commanders are not concerned—at least not enough. Current guidance from the Pentagon is poor, in part because it was based on inadequate advice from Engineers. Our mine-countermining doctrine is wrong, when it comes to who is responsible for what.

These views obviously do not represent an official position of the Army nor The Engineer School at Fort Belvoir, Virginia. They do, however, reflect a consensus

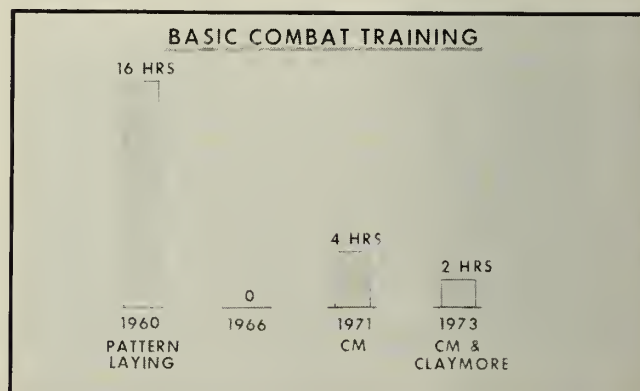
of the Working Group on Training Chaired by (me) Colonel Hylander at a Barrier/Counterbarrier Conference held at Fort Benning in May 1973. As such they are causing a new look at a number of actions, and they should be of interest to trainers in the field.

Mine and boobytrap personnel casualties, as percentages of total casualties, rose from three percent in World War II to 13 percent in Vietnam. Combat vehicle casualties, already high in World War II almost quadrupled in Vietnam. Commanders in Vietnam did get concerned, and in the late sixties that concern triggered studies by a board of general officers, by the Combat Developments Command, and by others. But it's now 1973, and let's look at that concern as it is reflected in mine-countermining training today.

In Basic Combat Training, trainees get only two hours (of a seven week, four day course); it is essentially an introduction to countermining warfare plus how to employ a Claymore mine. This is half what it was in 1971, but at least better than nothing in

	(% OF TOTAL CASUALTIES)		
	WWII	KOREA	VIETNAM
PERSONNEL	3	4	13
COMBAT VEHICLES	21	38	79

Mine and Boobytrap Casualties



Mine-Countermining Emphasis in Basic Combat Training

MINE TRAINING

ander, Jr.

1966. It is much less than the BCT trainee gets in First Aid, CBR, or guard duty, for example. In advanced Individual Training there are similar patterns: Infantry cut in half; Armor by 80 percent; Artillery to zero; and Engineer from 33 to 30 hours. This de-emphasis of mine-countermine training is also evident in NCO and officer courses. The reasons for these reductions are obvious: course lengths have been cut to save money and manpower; and mine-countermine training has suffered because it was not as important as other subjects.

So the trainees are not getting taught much about mines and boobytraps, and—more importantly—the NCOs and officers who will have to teach them during unit training are not being adequately taught how to fill the gap. Are commanders concerned?

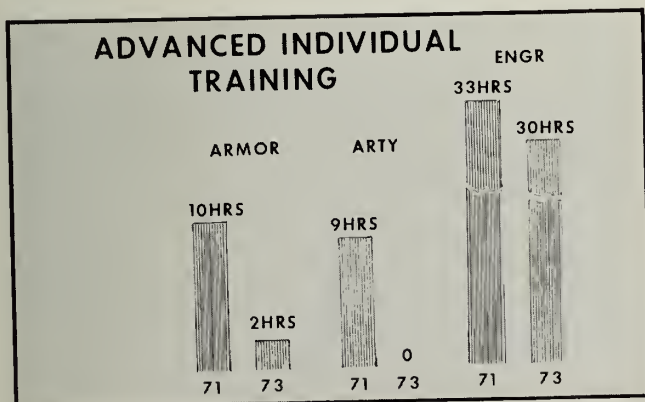
It should be noted that this does not necessarily condemn unit commanders for downgrading training conducted in their units. There is some good training at Fort Carson, where the 4th Engineer Battalion is

giving mine-countermine and LAW training to all elements of the 4th Division. There is good mine-countermine training elsewhere, from our observations on liaison visits, but there is also poor training and none at all sometimes. If the shoe fits, you be the judge. I know it fits some commanders in the Engineers as well as the combat arms, in the Reserve Components and in the active Army.

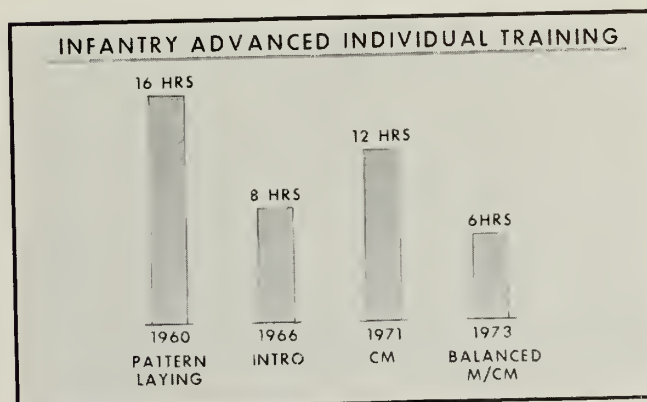
Let's look now at guidance from the Army Staff in the Pentagon, and at the Engineer advice upon which that guidance was based.

In 1971, the CDC Engineer Agency completed its Mine-Countermine Study (MICMIS), calling on the Army to:

- Increase emphasis on countermine and non-standard mine warfare, and including scatterable mines.
- Teach the total resource approach in all NCO, OCS, and officer school programs.
- Expedite boobytrap simulation devices.
- Establish mine-countermine experts in all combat



Mine-Countermine Emphasis in Advanced Individual Training



Mine-Countermine Emphasis in Infantry Advanced Individual Training

and combat support units, and teams on high staffs.

- Train these experts by quota and identify them by Special Qualifications Identifier (SQI) or prefix.

The Army Staff approved this study a year later, in 1972, but questioned the recommended density and location of mine-countermining experts, particularly those below battalion level. In 1973, still another year later, we are still trying to refine the requirements for these experts. Disagreements still exist, and we are a long way from seeing any of them appear in units.

The first three points above are motherhood. Nobody in his right mind would disagree. Nonetheless, we see no increase of emphasis, and I haven't been able to find out just what the "total resource approach" is. It isn't being taught, at any rate. The expediting of boobytrap simulation devices has hit some snags, too, that are covered in another article in this issue.

So let's examine the recommendations to establish mine-countermining experts in units, and to train them by quota and identify them by SQI or prefix.

The original MICMIS recommended density placed one enlisted specialist in each infantry and engineer squad, with others at platoon level. At company level there would be an M/CM NCO or officer, or both, and there would be an M/CM officer on the battalion staff (IN, AR, FA, EN, MP, MI). There would be teams of two to five M/CM experts on brigade and higher staffs. In an effort to refine this density downward to meet DA guidance, the Engineers proposed that there be one officer and one NCO on each battalion staff, the same teams at higher level, and two MOS-trained experts in each combat engineer squad. Combat engineer platoon leaders and NCOs would also receive special M/CM training as part of their regular training courses, with emphasis on their roles to advise, assist, and train others. Engineer experts would be identified by MOS; others by SQI or prefix; and all would be called "Sappers." This appeared to be a good compromise, but objections arose over two features:

- Units have too many special duty positions now. The infantry, in particular, objects to any new specialist tags. The Army is too short of manpower to add M/CM experts to TOEs, so the only recourse is to make it an additional duty for someone like an assistant S3, and to identify him and his position by a prefix. It is similar to the system for CBR specialists. All too often, the man becomes a part-time assistant S-3 and a part-time specialist, proficient in neither and not really his fault.

- A lot of people, myself included, believe that training by quota and identification by SQI are not

really viable. To get an expert, a unit must obtain a quota, then send a man off and pay his TDY for several weeks, and then when he returns try to spread him over his normal job plus his added special duties. Even if a man already has the SQI or prefix added to his MOS, the Army's present computerized personnel replacement system just cannot identify him and get him to a unit where his skill is needed.

The Engineer School is designing a rigorous hands-on training course for enlisted mine-countermining experts, and other training for the combat engineer tracks of officer and NCO basic courses. We are also seeking to reach some solution to the problem of providing mine-countermining experts in the combat arms, and we hope by the time this issue of **the engineer** is published that problem will be solved.

In the meantime, however, this problem is with us because the Engineers gave poor advice to the Pentagon, and it resulted in equally poor guidance coming back from the Pentagon. One other part of that Engineer advice was a conclusion that mine-countermining doctrine is sound. The more we struggled with the training problem, the more I began to look into just how sound the doctrine was. I've become convinced it has some flaws.

FM 20-32 outlines mine-countermining responsibilities as follows:

- All troops are responsible for individual countermining actions.

- Combat arms and combat engineers are responsible for emplacing mines and for deliberate countermining actions. You should note that there is no difference between combat arms and engineer responsibilities here. You should also note that it doesn't specify whether they are individual or unit responsibilities or both—just "combat arms" and "engineers."

- Engineers also provide technical advice and assistance, and "participate" in the planning, coordination, and emplacement of large-scale barriers.

Elsewhere in the manual, the small unit commander is reminded that he is responsible for anything and everything to do with mine-countermining operations, but he's told very little about how to do it.

There are two flaws in this doctrine as it is currently stated. The first is that individual and unit responsibilities are not clearly spelled out—either for combat arms or engineers. As a result, mine-countermining responsibilities have not been picked up and carried over into MOS definitions nor TOE capability statements, except for combat engineers. In today's Army, with its constraints on manpower and resources, individual and unit training is being very carefully analyzed

(systems engineered). Those subjects not clearly required by MOS duties or unit capability statements are being screened out of organized training and left up to the harassed unit commander to "insure proficiency." I believe this is the fundamental reason for the decreased emphasis described above; it has been systems—engineered out, in favor of other higher priority subjects.

The other flaw concerns a gap between the responsibilities of combat arms and engineers. Both are really responsible for everything, but combat arms officers can look at the engineer's role for advice and assistance and decide very conveniently "I don't really have to train much for this; I can call on the engineers when I need them." Engineers, on the other hand, do almost no training for that advice and assistance role; they train themselves for employment in mine-countermining operations and decide, again very conveniently, "If I'm ever asked for advice, I'll give it; meanwhile we have a lot of other things to do." So this role rarely gets exercised in peacetime training. When the casualties start falling in wartime, each can point to the other and say, "It's your job, go out there and lay (or clear) those mines." It happened in Vietnam, and Korea, and in World War II. If you don't train for it before combat, you don't do it very well when the guns are going off.

In order to correct these doctrinal gaps, The Engineer School is proposing to rephrase the responsibilities of individuals and units, and of unit commanders. These are described in another article in this issue, and are intended to be in the 1974 edition of FM 20-32, Mine-Countermining Operations.

There is one additional combat engineer unit responsibility being considered for inclusion—to provide training in mine-countermining (a barrier/counterbarrier) operations. This is really the heart of the solution to the overall problem. If others habitually come to combat engineers for help in training, and if engineers are ready to provide it, then we will be practicing the way it ought to work in wartime. It's already happening at Fort Carson and a few other places, and it ought to be happening everywhere.

In addition to changes to the manual, The Engineer School has undertaken the following:

- TF 5-4256, Mine and Boobytrap Training. Released in 1972, this is a good color film aimed at the individual soldier.
- "Don't Get Blown Up", a confidence-builder cartoon pamphlet being developed jointly with the Combat Arms Training Board. It should be distributed this fall.
- A new mine-countermining manual, with an ac-



companying unit training kit, aimed at telling the small unit leader (of all arms) how to do it and how to train to do it. This is pictured as the future "Bible" for the combat engineer's advisory and training role.

- Actions to create a "Sapper" mine-countermining enlisted expert and to develop an MOS producing course.
- Changes to combat engineer officer and NCO MOSs, and training courses, to add more mine-countermining expertise.
- Adding the mine-countermining training role to the capability statements in combat engineer unit TOEs.

There are also actions to expedite the development of new training devices for boobytraps and scatterable mines, but these are outside the scope of this already lengthy article.

In summary, there is a lot that needs to be done to get the Army (and the Engineers) with the problem of mine-countermining training. Much of it is underway. If you have ideas about how we can do a better job, or do it more quickly, just let us know.

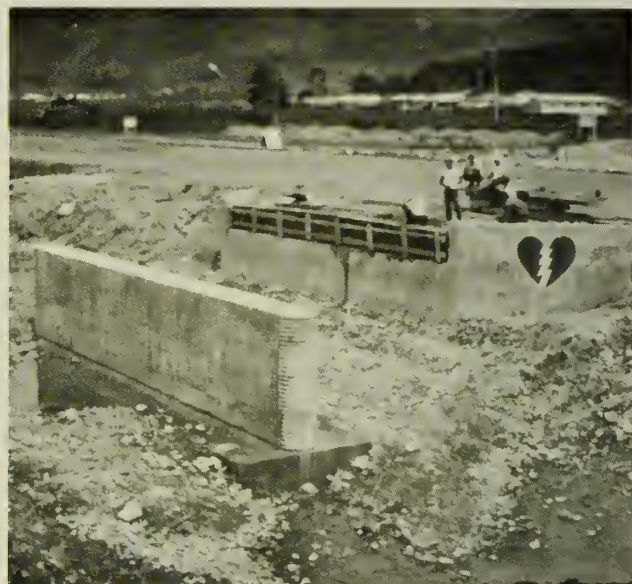
If you would like to know about the problems with camouflage training, go back through this article and insert "camouflage" wherever you see "mine-countermining."

Colonel Walter R. Hylander, Jr., Deputy Commandant for Combat and Training Development, at the Engineer School, has had tours with the 1st, 2nd, 3rd, 138th, and 288th Engineer Combat Battalions; the 487th Aviation Engineer Battalion (USAR), and at the Republic of Vietnam Armed Forces Engineer School. He holds a master's degree in Civil Engineering from M.I.T., and is a registered professional engineer in New York and a Fellow, American Society of Civil Engineers.

The Henry Larcom Abbot Award

Contract Construction For A Troop Unit

Captain Wardsworth A. Soders III



"To work on a multimillion dollar construction job." "To share the joy of participating in the construction of something BIG that will remain long after our lives have ended." Dreams of engineer soldiers of the seventies are written in those lines.

Only a small lot of us normally see the cement and aggregate of those dreams become concrete. Ordinarily, the joys of seeing such dreams become reality are reserved for those whose assignment darts pierce the Engineer District ring on OPO's big board. For the enlisted engineer soldier of the seventies; the dozer operator, or the carpenter who shares those dreams, the chance of awakening in his next assignment and finding them is slim, and more often than not, next to impossible. The average soldier reads about the big projects, or passes them on the highways and thinks to himself: "I surely would like to operate a pan on a big job like that", or "My squad could work rings around those guys", or maybe even, "What I wouldn't

give to command an outfit on that kind of a job."

Recently, such a dream became a realistic challenge for one of the Army's construction battalions, and consequently, for many of the Corps' young officers and hundreds of its enlisted personnel. The project of projects came to life when directive for construction of the Chinhae Ammunition Storage Facilities Depot was received by the 44th Engineer Battalion (Construction), (THE BROKEN HEART BATTALION), 2d Engineer Group, Eighth United States Army, Korea.

The Depot comprises better than half of a multimillion dollar Military Construction project under supervision of the U. S. Army Far East Engineer District of the Pacific Ocean Division, and is the largest troop construction project in the world today. Included in the total project are a new port facility capable of handling oceangoing ships, and a facility to store and maintain large quantities of ammunition. Con-

struction of the port was contracted to a civilian firm, and the maintenance and storage facilities construction was divided between a civilian contractor and the 44th Engineers. In essence, the battalion is working as a constructing agency for the District.

The scope of work for the Depot includes construction of 26 earth covered, reinforced concrete Stradley ammunition storage bunkers, seven maintenance buildings of reinforced concrete and masonry construction, a railroad loading and off-loading facility, and construction of several miles of all weather access road to the above mentioned structures.

The average dimensions of each storage bunker are 25 feet wide by 80 feet long with a height of 18 feet. The configuration is that of a concrete shell arch 30 inches thick at the base and eight inches thick at the apex. Due to the continuous pour volume requirements of the bunkers and other buildings, their construction was let to the civilian contractor. This left the excavation of bunker sites, preparation of the maintenance building pads, construction of the access roads and parking areas, and construction of the railroad loading off-loading facility to the letter companies of the battalion. Companies "B" and "C" are accomplishing the major earthmoving task, while Company "A" provides maintenance, quarrying, and paving support. All roads and parking areas of the Depot will be paved.

A typical bunker site is 50 feet above the toe of the slope of the mountains in which it is built, with a horizontal inset distance from the toe of slope of 150 feet. Such severe locations necessitated average vertical cuts of 30 to 40 feet through earth and rock with extremes of as much as 93 feet through solid rock in order to bring the sites to proper elevation for construction. Each bunker cavity requires a floor space of approximately 103 feet by 96 feet to allow proper orientation for construction of the critically spaced bunkers. Each bunker requires a horizontal distance of 180 feet at its closest points to adjacent structures. The tolerance in elevation between adjacent structures is 18 feet.

This critical layout in the rugged terrain of a South Korean mountain range was enough to keep at least two of the battalion's survey teams working continuously during that phase of the construction. Specifications required that the rock faces of the cavities be cut to given slopes, thereby producing a need for close coordination between the survey teams and the quarrying crews. Coupled with the tremendous volume of blasting work to cut the cavities was the requirement to crush the blasted rock for use in concrete and paving work. To keep up with these requirements, Company "A" operated four pneumatic track drills and a 75 ton per hour crusher seven days per week to keep on schedule during critical times. Frequent quality



control inspections were conducted by the battalion civil engineer section during this phase of the construction since failure to complete work meeting the required specifications on scheduled dates would result in delay of the contractors vertical work and substantial penalty cost.

The railroad loading off-loading facility consists of a one mile access spur and a platform capable of handling two bays of freight cars for loading or off-loading simultaneously. The entire railroad facility as well as five of the seven building pads and a large portion of the road network were built on rice paddy surface.

During the latter part of 1972, following a contract mixup, the battalion found itself having to construct an embankment approximately 80 feet high and 500 feet in length to provide road access to three of the 26 Stradley bunkers. Having this unforeseen require-



These five photos vividly show how engineers get their job done in any place where U. S. troops are stationed. Looking clockwise from top left: First photo—Five ton trucks haul fill that will be placed on a completed bunker by D-4 dozer. D-4 can be seen on the top of a bunker in the right center of the picture. Second photo—This road will be the same elevation as the bunker in the upper left hand corner when the massive fill job is completed. Third photo—Thousands of yards of fill will be needed to bring this road to final grade in front of the bunkers at the upper left and upper center of this picture. Fourth photo: A completed bunker awaits its turn for water proofing and back filling. Fifth photo: This bunker is ready for ammunition. Grass will be planted to prevent erosion of the backfill. Of course, all of these actions were completed—mission a success.

ment placed on them in addition to having to construct several protective berms in front of various structures, and being hampered by a long rainy season, the decision was made to augment the battalions earthmoving capability. This augmentation was accomplished by a platoon of earth movers from Company "B" of the 802d Engineer Battalion (Construction).

While the earth movers hammered out their work between rains, the concrete work on the bunkers was being finished. With the earth movers bogged down in work, the task of backfilling the completed bunkers was assigned to the vertical construction platoons of the battalion. This task was accomplished using five ton dump trucks, front end loaders, D-4 dozers, D-handle shovels and gasoline powered hand compactors.

From its beginning in late 1970, until its completion, the total volume of earth moved for this project will be in excess of 1.5 million cubic yards including the bunker site excavations and backfilling, the road network cuts and fills, the pads for the maintenance buildings, the railroad loading off-loading facility and the berms for protection of various structures in the complex.

To provide security for all of this, several small security buildings will be built by the battalion. Additionally, there will be fences built totaling approximately three miles of triple standard concertina and one and one-half miles of chain link fence.

Naturally, no project of this magnitude could be undertaken without giving due consideration to adequate drainage. Moving as much earth as this project dictates constitutes a considerable change in the natural runoff of the area. Consequently some of the major vertical construction effort is being expended on drainage structures. These include a 45 foot span steel stringer, reinforced concrete deck bridge, a reinforced concrete double box culvert spanning a 30 foot stream, and a double barreled 72 inch reinforced concrete pipe culvert. Also being constructed as an integral part of the drainage system is a 2,300 foot paved trapezoidal canal with varying bottom width.

When the Depot is completed, there will be an inherent danger of possible explosion from the ammunition stored there. For this reason, its location had to be an isolated one. Due to the isolation, the 44th Engineers were also tasked with construction and maintenance of a temporary cantonment to quarter themselves during construction. The battalion strength

during the project has averaged 22 officers, 460 U. S. enlisted personnel, 340 Korean Augmentees to the United States Army, and approximately 200 Korean Nationals of the Korean Service Corps.

The camp built to house the soldiers contains some semi-permanent buildings that will be left for use by the units manning the Depot. The major shelters and other needed facilities of the camp however, are comprised of portable moduls called Porta-Kamps. These are 10 ft. by 30 ft. and 12 ft. by 30 ft. trailer house type structures mounted on skids which the battalion has found suitable for every practical purpose from sleeping quarters to supply and orderly rooms as well as day rooms and recreational clubs. The camp is completely self-supporting.

Soldiers of the battalion along with their Korean co-workers man a mini Facilities Engineer Shop for the camp. This has provided the opportunity for soldiers to install and maintain an electrical distribution system, a water purification and distribution system, and a limited sewer system. All of these systems were designed in the battalion civil engineer section. Even the electrical power distributed throughout the camp is produced by troops in the appropriate MOS.

The living conditions at the "Broken Heart Compound", as the camp is called by the members of the BROKEN HEART BATTALION, are not the best, and the soldiers often complain, but the morale is high when the work is good, and what better work is there for the engineer soldier than that contracted by a District Office of the U. S. Army Corps of Engineers?

Captain Wardsworth A. Soders III calls Marlin, Texas home. He is a graduate of Prairie View A & M College of Texas, with a BS Degree in Architectural Engineering. He was commissioned in The Corps of Engineers upon graduation in August, 1967 through the ROTC program. Military assignments have been: Platoon Leader, 497 Engr. Co. (PC), Vietnam, 68-69; Engineer Representative to the U. S. Army Military Police School, Ft. Gordon, Ga. 69-71; S-3 Officer, 44th Engineer Battalion (Const.); and Commanding Officer, Company C, 44th Engineer Battalion (Const.), 71-72. He is presently a student in the Engineer Officers Advance Course, class 1-73.

MINE-COUNTERMINE TRAINING DEVICES

Major A. J. Christensen

The best way to train a soldier in mine-countermine subjects is to train him using live mines and fuzes. Most Americans would disagree with this type approach and mothers would have apoplexy if they thought their sons were going to be trained in such a dangerous way. Since these situations exist, there have to be training devices available which can be used repetitively; which will assist in making the training effective, and which are of little or no danger to the trainee.

There are presently seven AP mines (non-chemical) in an inert or practice version listed in *Supply Catalog* 1340/98IL. Of the AP mines listed, there are existing stocks of the inert M18A1 and the practice M8 (components only).

The situation on AT mines is not much better. There are two practice versions listed in the supply catalog; however, only the M20 practice mine is available in any quantity. Since the practice and inert versions are not presently stocked in sufficient quantity for issue, there needs to be a rapid means available to make up a model mine that can be quickly and economically produced.

A plastic mine model approach has been taken by the Combat Arms Training Board (CATB) at Fort Benning, Georgia. Two AP and three AT plastic mines were produced for the CATB and tested at Fort Carson, Colorado by the 4th Engineer Battalion (C) and Infantry and Armored Units of the 4th Infantry Division (Mechanized). These plastic mines were very effective training devices. Other agencies have been working on a different approach.

A recommendation was submitted by the US Army Engineer School (USAES) to HQ CONARC for changing CTA 23-103. This change, if adopted, will authorize issue of practice or inert mines in sufficient types and quantities to allow Combat Engineer Battalions to install a 300 meter-front minefield with a 1-2-2 density using M20, M35 and M17 practice mines and for classroom hands-on instruction for a platoon-size class on the M2, M3, M16A1, M18A1, M26, M19, M21, M25, and M14 inert mines.

Foreign mines, both friendly and enemy types, must also be duplicated in necessary quantities to enable them to be used for classroom instruction. These mines are essential for rounding out the mine-countermine training of the US Army. There also needs to be a method developed for adding realism to mine-countermine training.

An urgent requirement exists for more effective and realistic training in the detection, recognition and avoidance of mine antidisturbance devices. The need is for a modular device which provides stress and realism in mine-countermine training by simulating the characteristics and effects of existing service mines.

One solution is a universal scoring module (USM) which is now under development. Triggering of this device by personnel or equipment causes a noise and a spray of a nontoxic, easily removable, dye or powder which marks the triggering cause, if it is within the spraying pattern.

The proposed USM is compatible with M16, M16A1, M18A1, M14, M19, and M12 mines but it does add to the depth of cover required, and burying it in soil affects its performance.

Solutions to the current shortage of training devices must be arrived at as expeditiously as possible, but any solution must not sacrifice the ultimate goal of being able to conduct realistic and meaningful training.

Major A. J. Christensen is the Chief, Training Publications Branch, Doctrine and Training Literature Division, Department of Doctrine and Training Development, US Army Engineer School. He was with the Combat Developments Command Engineer Agency as Chief, Doctrinal Literature Branch, Organization and Doctrine Division for two years prior to the merger with USAES in March 1973. He holds a BS in Agricultural Engineering, MS in Mechanical Engineering and is a graduate of the Basic and Advanced Officer courses at Fort Belvoir, Virginia. The major has served with an engineer brigade in Europe, Construction battalions in CONUS and Thailand, as an advisor in Vietnam and as a Facilities Engineer.

Bridging the Gap



FIXED QUOTAS TO BE SET FOR MAINTENANCE WARRANTS NEW INTERMEDIATE COURSE IN FY 74

BEGINNING IN FISCAL YEAR 1974, fixed quotas will be established for those eligible individuals who desire to attend the new Maintenance Warrant Officer Intermediate Course. The course, comparable to an officer's advanced course, was launched last year through the combined efforts of the Ordnance and Engineer Schools. Those selected will be considered in light of manner of performance, potential value to the Army, education and type of assignments in which the officer has served. The course is conducted in two phases: the first, approximately 11 weeks in duration, consists of general military subjects and is taught at Aberdeen Proving Ground, Maryland, to both Ordnance and Engineer Warrant Officers; the second phase, lasting approximately five weeks for MOS 621A, consists of engineer technical subjects, and is taught at Fort Belvoir, Virginia. Since the entire course is less than 20 weeks duration, it must be funded as TDY from local training funds. To be eligible for consideration, an individual must have completed the Engineer Equipment Repair Technician Course and have between 5-13 years of warrant service. For those individuals who have not had the opportunity to attend the EERTC, there are quotas available that can be allocated on a TDY and return basis. The Engineer Branch will provide the quota, the individual's unit cuts the orders and funds the TDY. For EERTC quota information, call the Engineer Branch: AUTOVON 325-7434.

ENGINEERS MUST NOW REQUEST THAT NEW MAP READING HANDBOOK FROM AG PUBLICATIONS CENTER

THAT NEW DEPARTMENT OF THE ARMY Training Circular 21-26, "Don't Get Lost," a cartoon style pocket hand book that simplifies map reading for the individual soldier is going over big. Conceived by the U.S. Army Engineer School at Fort Belvoir, Virginia, and developed jointly with the Defense Mapping School and the Combat Arms Training Board, this new look in informal training literature will soon be followed by "Don't Get Shot" (Camouflage and Field Fortifications) and "Don't Get Blown Up" (Mines and Booby Traps). Engineer units that need copies should send their requests to the U.S. Army Adjutant General Publications Center, 2800 Eastern Boulevard, Baltimore, Maryland 21220. Earlier, Engineer units were requesting copies from the Combat Arms Training Board at Fort Benning, Georgia.

DA SELECTION BOARD PICKS THREE SFC'S FOR ATTENDANCE AT PHOTOLITHOGRAPHY NCO COURSE

THE ADVANCED COURSES of the NCO Education System (NCOES) were initiated in January 1972. These courses are designed to prepare personnel in grades E-6 and E-7 to perform duty as noncommissioned officers in grades E-8 and E-9. A DA Selection Board comprised of officers and noncommissioned officers selected a number of personnel to attend the advanced courses programmed for Fiscal Year 1973. Three Sergeants First Class Everett D. Bogle, Frederic M. Church, and Donald W. Koons were named to attend the Photolithography Chief NCO Advanced Course at Fort Belvoir, Virginia from April 22 through July 18 of this year.



THE CORPS OF ENGINEERS



They've a song about the Army,
The Navy and Marines;
They've got one for the Air Force,
The whole damned works it seems;

But they've never taken trouble,
Though we've served them all these years,
To even pen a line,
For the Corps of Engineers

We've built all their roads and airfields,
Their pipelines and their camps;
From underground munition dumps,
To concrete loading ramps;

Railroads, dams, and bridges,
Electric high power lines,
Canals and docks and harbors,
Even coal and iron mines;

But the Engineers aren't kicking,
For when those outfits do come in,
We know it's just another place,
Where we've already been;

Before they even got there,
We had to break the ground,
And build it all to suit their needs,
Solid, safe, and sound;

If the Army and the Navy,
Ever look on heavens scenes,
They may find that it is guarded,
By the United States Marines.

Now who will guard the streets up there,
We aren't disposed to say,
But we offer this suggestion,
If they look at things that way;

When the Marines have taken over,
In the land that knows no years,
We're sure they'll find—
It was all designed,
By the Corps Of Engineers.

H. W. Willhoite

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THE ENGINEER



SPRING 1974

THE ENGINEER

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CHIEF'S BRIEFS

Alexander Macomb, the U. S. Army's ninth Chief Engineer, was born April 3, 1782, in Detroit, Michigan.

He entered the Army as Cornet of Cavalry in 1799 and was appointed as a second lieutenant in the Infantry in 1801. He was promoted to first lieutenant in the Corps of Engineers in 1802 and rose to the rank of lieutenant colonel in eight years — 1810. In 1812 Macomb became the Adjutant General of the U. S. Army and a colonel in the 3rd Artillery.

Later, as a Brigadier General, he commanded the Lake Champlain Frontier Army and defeated the Duke of Wellington's Veterans at Plattsburg, N. Y. in 1814. The Congress voted its thanks to Macomb, awarded him a Gold Medal for his leadership and shortly after breveted him a Major General.

In the reorganized Army, constituted by the act of March 1821, Maj Gen Macomb was appointed Colonel in the Corps of Engineers and named Chief Engineer in that same year. It was during his tenure as Chief of the Engineers that the birth of civil functions took place as part of the many other jobs undertaken by the military engineers. The act of April 1824 assigned civil functions to the Engineers to procure the necessary surveys, plans and estimates upon the subjects of roads and canals.

On May 24, 1828, General Macomb relinquished command of the Corps of Engineers to become General-in-Chief of the Army as major general.

Wearers of the Engineer insignia may be intrigued to learn that Macomb made the earliest known drawing to resemble the Engineer Button in 1807.

It also is interesting to note that Macomb was the Army's General-in-Chief when the castle insignia was designed 32 years later.

Macomb died on June 25, 1841, at Washington and was buried with the highest military honors in the Congressional Cemetery.

U.S. Army Engineer School Fort Belvoir, Virginia

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The Engineer is an authorized quarterly publication of the U.S. Army Engineer School. It is published to provide factual and in-depth information of interest to all Engineer units. Articles, photographs and art work of general interest may be submitted for consideration to: Editor, The Engineer, USA Engineer School, Fort Belvoir, Virginia 22060. Views and opinions expressed herein are not necessarily those of the Department of the Army. Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, January 1, 1974.

Subscriptions to THE ENGINEER are available through The Engineer School, Book Store, Fort Belvoir, Virginia. Annual rates are \$6.00 for mailing to a domestic or APO address and \$6.75 for mailing to a foreign address. Individual copies of the magazine are \$1.50 each. Checks should be made payable to the Fort Belvoir Book Store.

THE LIBRARY OF THE

JUL 8 1974

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

ABOUT THE COVER

No more bitter example of brother pitted against brother can be found than during our own Civil War. Art Director John W. Savage, Jr., depicts the awful hour when Union troops rushed across engineer constructed ponton bridges during the "Battle of Fredricksburg." See associated article "It Was A Gallant Work" beginning on page 22.

PIPELINE. PIPE

FAIR BOOSTS ENLISTMENTS FOR RESERVES

"Popcorn, Peanuts, Cracker-jacks — Try the Elephant Ride — Three darts for a Quarter, Every one a winner! — Join the Army Reserve."

Sure enough, on the Midway of the Mid-South Fair in Memphis, Tennessee, wedged between an eating stand and an elephant ride, was an Army Reserve Recruiting Booth.

"We go where the people are. If we wait for them to come to us, we're not doing our job," was First Sergeant Rick Keene's explanation of the incongruous location of the 467th Engineer Battalion's Recruiting Booth. "If I were sitting in the USAR center I wouldn't have a chance to talk to the 50 or 60 people a day that I'm averaging here."

Sergeant Keene's feelings were echoed by Major Ronald Slayton, who was also assisting the recruiting effort. A full-time technician with the unit, Slayton explained, "In the 467th, recruiting is everybody's business. We're all ready to come out to the Fair or any other gathering to tell the Army Reserve story."

The story must be well told if recruiting figures are any indication. Since its formal activation in November, 1971, the Memphis based Combat Engineer Battalion, part of the Army Reserve's 412th Engineer Command, Vicksburg, Miss., has reached 85 percent authorized strength. This means that in less than two years, the unit has recruited 600 personnel.

First Sergeant Keene, a full-time recruiting technician for the Army Reserve, led the crew at the fair and insured that the recruiting booth was manned as long as the Midway was open. This meant many 14 and 15 hour days for the recruiters of the 467th, and for the personnel manning the other recruiting booths. For, in addition to the Army Reserve, the National Guard (Army and Air), Navy, Navy Reserve, Marines, Marine Reserve and Active Army were all represented on the Midway.

When questioned about the competition, Chief Warrant Officer Bobbie Coleman, full-time Staff Assistant with the 467th replied, "The more recruiters there are the better the business is. We refer young men and women to other branches and other units if we see that they have experience in areas that we can't use and where they desire to work. Likewise, we receive referrals from the other recruiters when they find out that someone wants to be in an Engineer unit. Don't get me wrong. We don't give up anyone without trying to sell the benefits of our program, but we do keep the individual's interests at heart."

First Sergeant Keene seconded Chief Coleman's motion for fairness. He said, "If we don't do what's right for an individual he's going to be unhappy. If he's unhappy with our unit and his job he's going to be a negative influencer and hurt morale and retention. We know that we're fighting for numbers, but we have the full backing of everyone from our battalion commander to Gen-



All prospects receive equal attention but some receive more attention than others. First Sergeant Rick Keene tells Jean Davis about the benefits of Army Reserve service.

eral Hamner (412th Engr Bde Cdr), in seeking quality. To us doing the recruiting, quality starts with satisfied individuals. This may sound strange coming from a recruiter, but we've been successful and our recruiting figures speak for themselves."

Major Slayton added, "It's like this Fair duty. We talk to a lot of young kids and to a lot of young women. They may not be ready to join our unit, but they do have older brothers and boyfriends. If they see us out here, meet us, talk to us and find out that we have their interest at heart, and that we won't pressure them into signing, we make friends, and cultivate future prospects. We're recruiting for the long haul, not to fill up with anyone who can see lightning, hear thunder and eat jello."

The week-long fair gave the Reservists a chance to display their equipment and tell their story to many prior servicemen and to those with no service experience.

LINE. PIPELINE.

The results may be measured in enlistments, a prospect list or the broader good extolled by all three of the men interviewed; the chance for the Reserve to tell its story and show itself to the public in a positive manner.

By any standard the operation should be labeled successful.

CRREL SCIENTISTS MAKE GOOD USE OF SKYLAB PHOTOS

The Skylab crew took photos of the Connecticut River and Merrimack River basins in 1973 as part of a study conducted by the U. S. Army Cold Regions Research and Engineering Laboratory and the New England Division of the Army Corps of Engineers.

The photographs taken by Skylab will be used to study the flood plain, vegetation distribution and land use of the two river basins.

Information obtained will be used to characterize the environmental factors which are critical to the New England Reservoir System. Based on the imagery, flood plain, vegetation and land use maps will be developed for selected watershed areas. In conjunction with the Skylab photographs images will be obtained by aircraft flying at 3,000 and 5,000 feet. Correlation will be made with Earth Resources Technology Satellite imagery taken during the same period.

Ground level information will be obtained from 25 automatic data platforms throughout New England which are operated by the New England

Division. These platforms, which transmit their information through the Earth Resources Technology Satellite twice daily, give data on river stage, precipitation and temperature.

LIGHT NAMED TECH DIRECTOR AT DMS



Donald L. Light has been named Technical Director for the Defense Mapping School (DMS), according to an announcement made by Lieutenant General Howard W. Penney, Director of the Defense Mapping Agency.

At the present time, Mr. Light is attending the Naval War College, Newport, R.I., and will assume his new duties upon graduation in June of 1974. Prior to leaving for the War College, Mr. Light had

been detailed to DMS. At that time his specific task was establishing top level technical and professional positions needed for development and execution of an improved mapping, charting and geodesy curriculum. Additionally, he has formulated a broad guidance on the probable impact of technology on the DMS curriculum.

Mr. Light, prior to his new appointment, served with the Defense Mapping Agency Topographic Center (DMATC), Washington, D. C. Before that he was with the U.S. Army Topographic Command from 1966 until it was incorporated into the Defense Mapping Agency in 1972.

He is a graduate of George Washington University, with a B.S. in Geodetic Science, and has attended courses at the University of Illinois, and UCLA, in California.

ENGINEER DINNER DATE SET

This year marks the 107th Anniversary of the traditional Annual Engineer Dinner. The event will take place at 6:30 pm, April 26, 1974, at Mackenzie Hall, Fort Belvoir, Virginia. The theme for this years dinner is "THE CORPS-SUPPORTING THE ARMY AND SERVING THE NATION."

Request for reservations must be made not later than April 15, 1974 by writing to The 107th Annual Engineer Dinner, Post Office Box 107, Fort Belvoir, Virginia 22060 or calling Fort Belvoir 664-3939 (Autovon 354-3939)



The Army is undergoing a period of time in which its strength is being reduced to a lower more austere figure. The force structure is being lowered by the deactivation of units to meet a major portion of this reduction. The implications are varied and obvious to all. They range from the hardships of managing with fewer resources to the benefits of increasing stability in long-tour assignments. One facet is not so obvious and is being used to meet a significant portion of the strength

AUSTERITY FACES ENGINEERS

Major Douglas K. Lehmann

reduction. It is austerity within individual TOE. Less known now, it will become obvious and remain with us long after the initial force reductions have been made.

Austerity is being ushered in by development and publication of the H-series TOE from the current G-series TOE. The full impact will be felt as units are required to submit MTOE based on these new H-series TOE. These conversions have started. After being reorganized under an H-series TOE, organization austerity will no longer be obscure, but a keyword of the Seventies. For example, the H-series TOE was published in November 1970, for the Engineer Battalion in the Infantry and Armor/Mechanized Infantry Division and the Engineer Company organic to each of the five type separate brigades. The strength changes of the two battalions were:

	G-Series	H-Series
Engr Bn, Armd/Inf Mech Div, TOE 5-145	1017/1019	984/1001
Engr Bn, Inf Div, TOE 5-155	988/990	776/793

(The two strengths within each series depend on the bridging version authorized — either MAB or M4T6).

Before examining other TOE facts of austerity, it is important to understand the basic philosophy about the current austerity program. Austerity is not new and has been prominent at the end of every wartime mobilization period. What makes organization austerity unique for the Seventies is its interaction with the Volunteer Army concept. Each concept had separate origins, but now shares branches of the same tree. The underlying drive behind the Volunteer Army is improving significantly the quality and professionalism of the Army.

The new TOE austerity is geared to reducing the number of positions and specialties requiring unique training, knowledge and experience. This results in organizations with only the personnel needed to accomplish the mission and stated capabilities. It can only be done with quality personnel who have increased opportunities, challenges and satisfactions. When the latter is obtained, Volunteer Army goals are complimented as service is more attractive beyond initial obligations. A "grassroots" explanation might be easier to understand.

The Volunteer Army concept removes service irritants and "make-work" details to provide meaningful training and duty. The TOE previously absorbed this non-productive effort. Any effort that cannot be transferred from non-productive

time to productive time (which includes dynamic training) is organizational "fat" and must be trimmed. This is the why of TOE austerity. In order to work, it must have full support of the Army's leadership in concert with the goals of the Volunteer Army concept.

What is the methodology of TOE austerity? The traditional peacetime method is to organize under reduced strength levels of two (90%) or three (80%). The H-series divisional TOE have been carefully tailored in level two for realistic reduction and reflect actual experience.

The H-series has inaugurated the use of placing in augmentation paragraphs entire capabilities completely divorced from Levels 1, 2 and 3 of the basic TOE. These paragraphs are designed only for wartime use or special MTOE applications. TOE 5-115H, Engineer Construction Battalion should see the entire second shift construction capability placed in augmentation. Variation 30, TOE 5-148H Bridge Company, Engineer Battalion already has the 3rd crewman of each MAB unit in augmentation. Certain individual positions are also being removed from all H-series TOE and placed in augmentation paragraphs. Unless your unit receives DA approval to use augmentation paragraphs, you will no longer have:

- Cooks Helper, E-3, MOS 94A10 in Company Mess Sections.
- Chemical Staff NCO, E-6, MOS 54E40, in Battalion Operation Sections.

Additionally the Unit Supply Technician, WO, MOS 761A0 in Battalion Supply Sections has been placed in augmentation and will no longer be authorized when the Division Logistics System (DLOGS) has been implemented. This system removes the property book from battalion and consolidates it at division level.

Another aspect of TOE austerity directly attacks the organizational "fat" previously mentioned. The best example of this can be shown in the communication personnel authorized a line company. The H-series are standardized at no more than three or four men, usually a "commo" chief, radio mechanic, and wireman. The company radio NCS and switchboard must be co-located and 24-hour operation forces all personnel to hold 8 to 12-hour shifts with no room for non-productive time. The G-series engineer TOE are in the process of being updated to authorize no more than four or five "commo" personnel. In those units where only one or two commo personnel are authorized, the commander must seriously question the requirement for 24-hour operation or devise an alternate arrangement utilizing other CP personnel.



What is on the drawing board? The following list does not represent approved doctrine but indicates vividly the trend for future austerity —

- The development of a light (10,000 man), heavy (12,000 man) and experimental division (similar to TRICAP). The first two envision an engineer battalion with no organic bridging (located at Corps) or ADM (located at Brigade) and a strength as low as 425-532 men. The latter's forerunner is being evaluated at Fort Hood, Texas. This is the most versatile and complex division ever fielded. Yet its engineer battalion of 844 men is 140-175 below the strength of its counterpart in the Armored Division. The battalion is organized under TOE 5-185T (Tentative) with two of its four line companies converted from armored to airmobile under TOE 5-227T. These three divisions would replace the current six — Armored, Infantry, Mechanized Infantry, Airborne, Airmobile and TRICAP.

- The development of an engineer equipment support company. This will revise TOE 5-58G to include an airmobile equipment platoon and a 20 ton dump truck platoon to replace two of the existing three equipment platoons. This would delete the normal requirement for a (5 ton) Dump Truck Company in a type Corps. The result in a type Corps would increase capability and decrease strength by 194 (2 companies).

- The development of a new panel bridge company. This envisions replacing the current Bailey Bridge with the British inspired Medium Girder Bridge. When developed, and company with two or three sets, each 100 feet long, would replace two existing Panel Bridge Companies, TOE 5-77. In a type Field Army this would save 375 personnel spaces (3 companies).

How can you help to see that austerity measures are properly identified in TOE? First an understanding of the TOE/MTOE system is required. The basic structure is only modified to achieve a quality product incorporating restraints and additional austerity measures as appropriate. Since 100 percent of Army units are organized under an MTOE, how do TOE changes affect the Army in the field? The answer lies in the TOE/MTOE relationship. TOE are developed under a concept which visualizes wartime employment of a unit anywhere in the world. MTOE may be used during wartime or peacetime situations for adaptation to a specific geographical area of the world or to meet special missions or operational requirements. About 10 percent of MTOE are the same as the basic TOE; the other 90 percent, while different, must follow line by line the format of the basic TOE. MTOE increases and decreases must be documented, justified and forwarded to the Department of Army. The impact of the basic

TOE is therefore considerable since changes are few in number for most units.

Supplementary information in this article shows examples of constraining regulations of the TOE/MTOE system. In brief, personnel authorizations are based upon AR 570-2 and operational requirements. Grades for all personnel are found in the AR 611 series. Equipment requirements are based upon AR 310-34, basis of issue plans (BOIP) and operational needs. BOIP are not available at unit level.

Certain equipment is not shown as required in TOE. For example, expendable equipment is generally not included and is found in SB 700-50, Expendable Items (Except Medical, Class V, Repair Parts and Heraldic Items) and SB 8-100, Army Medical Department Expendable Supplies. Common Tables of Allowances (CTA) authorize certain other types of equipment your unit would need. For example, CTA 50-914, authorizes Individual Safety and Protective Clothing and Equipment. This CTA is the authorization to get your wireman or electrician a set of tree and pole climbers. Likewise, AR 840-10, Description and Use of Flags, Guidons, Tabords and Automobile Plates authorizes your unit guidon.

These documents are all listed in Section I of your TOE. MTOE documents will not repeat information in Section I, but will list significant changes from the basic TOE. Both documents are required to get a clear picture of the mission and capabilities of your organization.

Army Regulation AR 310-31, Management System for Tables of Organization and Equipment (the TOE System) gives general guidance on all other areas of the TOE. This includes the provision that suggestions for changes be submitted through command channels. An "ad" in Section I of the TOE extends this prerogative.

People who work with TOE are receiving suggestions on improvements that add people and equipment. This information is required but of an equal need is information on what is not needed.

What equipment or skill can be removed and pooled at the higher headquarters TOE? Where are over trained personnel functioning in positions in which less skilled personnel would suffice? What positions and equipment can we simply do without?

If the TOE developer doesn't get this information, austerity will force deletions based on the best information available from only a few field users. A requirement that MTOE developers usually must follow is useful knowledge for all. All MTOE additions require an equal number of deletions. Trade offs are the name of the game at DA. For example, if your unit has the PLL Clerk in augmentation, and it is not augmented, you can

still place the PLL Clerk in the basic table if you can identify another position for deletion, such as the dispatcher.

Suggestions should be based on the knowledge that the TOE reflects only the normal mission of the unit. Regulations require that only minimum essential personnel and equipment be authorized. Where personnel changes must result in the same or lower strengths, equipment changes also should be less expensive. TOE's must be cost effective. An example is TOE 5-77H which is now approved to delete 19, five-man, Cook Sets w/Stove while adding only one, 70-man Cooking Outfit at a savings of \$84. (Prices of equipment can be found in SB 700-20, Army Adopted/Other Selected Item and List of Reportable Items). Nor does the TOE have to be self-sufficient.

Each new H-series TOE places more dependency upon other units for certain capabilities. For example, TOE 5-157G, Engineer Combat Company is being changed to show tracked vehicle organization maintenance dependency upon TOE 5-156G, HHC, Engineer Battalion, Infantry Division. Recently TOE 5-77H, Engineer Panel Bridge Company, was reduced by 25 spaces since its normal mission requires other Engineer units to erect the Bailey Bridge.

Austerity in Engineer Organizations will be the keyword for TOE development of the Seventies. General Lesley J. McNair (1883-1944), an organizational genius, demanded that all units be functional without excess personnel or materiel, and he questioned everything that went into a TOE. The same is true today and the Volunteer Army concept is embodied in the same terminology of General McNair's time where he strived for "lean and mean" organizations.

The Engineer has always been challenged to use manpower and equipment resources efficiently. He must now do so with even more austere forces than before, using basic management principles that demand no undo strain on a soldier's time as a part of "Today's 'NEW' Army."

Major Douglas K. Lehmann holds a BS degree in Forestry from Syracuse University and a MSA degree in Systems Management from George Washington University. He has been a Company Commander in the 97th Engineer Battalion (Construction), Germany and 26th Engineer Battalion (Combat), Vietnam. He also has held additional staff positions in the 8th Engineer Battalion (Combat), Korea, 91st Engineer Battalion (Combat), Ft. Belvoir, and 32nd Engineer Group (Construction), France and Ft. Hood. Since 1969, the major has held successive assignments at Ft. Belvoir of EOAC student; Office of the Director of Instruction, USAES; "Bootstrap"; and USACDC.

GEOLOGY AND THE CORPS

Captain John J. Connor

Captain Kevin J. Mahoney

In the summer of 1964, a United States Army Engineer advisory unit was sent to the vicinity of Khe Sanh, South Vietnam to direct construction of an airstrip for C-130 aircraft. Initial estimates indicated that the project could be completed in 48 hours. All that was really needed to do, or so it seemed, was to level some rolling terrain and lay the matting. Two weeks later the project was finally completed! The big stumbling block was the presence of solid rock just below the surface which required drilling and blasting to remove. The rock had gone unreported in spite of the presence of several outcroppings. The commander of that unit is now a vocal advocate of the importance of geology in military engineering. Excerpts from the description of MOS code 1940 "Geologist" contained in AR 611-101 shows that a geologist must be able to do more than just identify rocks.

"Prepares military geologic maps; . . . acts as consultant on . . . location and evaluation of natural construction materials, . . . water supplies, . . . (and) foundation conditions; (and) interprets terrain features and aerial photographs for preparation of military intelligence reports."

The use of geology by the U. S. Army under combat conditions began in France in 1917 and has expanded through three succeeding wars. The Corps of Engineers has, however, been involved with geology almost from its beginning, spanning 200 years and millions of miles, from colonial times to the space age, from the western frontiers to the highlands of the moon.

One of the first major applications of geology within the Corps of Engineers came as a result of a \$5,000 allocation by Secretary of War John C. Calhoun in 1820 for a survey of the Ohio and Mississippi Rivers from Louisville to New Orleans. Although the primary concern of the expedition was steamboat navigation, it also included an evaluation of the stratigraphy and geologic formations encountered along the way. Soon another expedition set out to survey Michigan and the Upper Mississippi. Engineer officers were joined by civilian scientists, among them a mineralogist, Henry R. Schoolcraft who documented the rich lead deposits of the Upper Mississippi and the vast copper reserves of the Lake Superior region.

Amid this increase in western exploration, a separate Corps of Topographical Engineers (1838-1863) was formed to survey western rivers, locate wagon routes, build roads, and investigate geologic resources. The work of Army Engineers, including a series of expeditions led by Lieutenant George M. Wheeler, greatly increased the knowledge of the geology, zoology, and botany of the growing nation. These and other early surveys revealed the importance of geology in America's future and led to the creation of the United States Geological Survey in 1879.

The construction of the Panama Canal stands as perhaps the greatest engineering feat of the past century, and geology and the Corps of Engineers are two integral elements in that story. Geologic considerations were, in fact, very instrumental in the selection of the canal's route, and were of great significance throughout its construction.

For years a worldwide debate had raged among isthmian canal advocates as to whether to build it across Nicaragua or at its ultimate location-across Panama. International politics effectively resolved the argument. But the unstable geologic condi-

tions along the proposed Nicaraguan route were also influential. Geologists pointed out that Nicaragua was an "active" geologic region and that on its eastern coast 169 earth tremors had been recorded from January 1901 to April 1904. They classified 35 of these tremors as "strong." During the same period only 10 movements were recorded in Panama; none of them of significant force. Additionally, the Nicaraguan route passed close to an active volcano, Ometepe, which had violently erupted as late as 1883.

Even after the choice of route was made, and construction begun, geology was still of prime concern to the American engineers in charge. Major General George Goethals, Chief Engineer of the Isthmian Canal Commission, gave ample treatment to geologic problems in his treatise that was published in 1916.

The most awesome element in the construction of the Canal was the excavation of the immense Culebra Cut through the Continental Divide. Officially designated the Gaillard Cut by Executive Order in 1915, its eight and one-half mile length required 26 years of work and the removal of 100 million cubic yards of material, mostly solid rock that required drilling and blasting. Excavation of "The Cut" was plagued by frequent and massive rock slides that accounted for nearly 30 percent of the material which was removed. In order to solve this unanticipated problem, geologists were asked to recommend ways of stopping the slides. But there were complex geologic conditions which required a variety of measures at various locations since the slides were the result of four different conditions.

Some slides were caused by saturated clay sliding on inclined layers of hard rock, while other slides occurred where rock was broken by faults. Still others were the result of ordinary weathering and erosion. A fourth type of slide, called a "break," was the result of the weight of overlying rock acting on weaker rocks which were exposed in the cut far below the surface. This caused banks to slide and forced the bottom of the excavation to rise. Geologists felt the only way to overcome this latter situation was to remove additional material from upper levels and check the other slides by driving piles through the troublesome material into solid ground or by dumping large pieces of blasted rock on loose surfaces.

The first ship passed through the Panama Canal on August 3, 1914, six days after Austria's declaration of war against Serbia which triggered the beginning of World War I. Less than three years later, the United States entered the war, and for the first time American geologists were on the front lines overseas. At home, geologists were busily engaged in finding mineral resources needed

for the war effort. And overseas, because of the very nature of trench warfare, geologic considerations often proved to be a factor. In many cases, however, the geologists' efforts were directed toward overcoming ignorance and prejudice.

Few high-ranking officers on either side had an adequate conception of the applications of geology to military problems and the results of geologic investigations were very often ignored. For example, at one point during the Battle of Verdun, French troops were ordered to "dig-in" on a plateau where less than a foot of soil covered the bed rock. The task was impossible and resulted in a large and needless loss of life.

British engineers shipped road aggregate from England, even though geologists could have found available sources in the theater of operations. German troops used water witches to locate well points. And right after its arrival in France, the American Expeditionary Force used no method at all to locate well points. However, because of the earlier follies of her Allies, the AEF soon learned to pay heed to organized geologic work. A geology section comprised of two officers was established as a part of the Office of the Chief Engineer of the AEF in September 1917. In July 1918, positions for geologists were authorized on the staffs of the Chief Engineers of each of the Field Armies, and in August the section at AEF headquarters was increased to six. This brought the total of authorized geologist positions to 18, although only nine were ever filled at any one time.

Major applications of geology in the war included the construction of field fortifications, trenches and tunnels, and the location of sources of water and road aggregate. In the construction of trenches, knowledge of geologic conditions proved to be a vital necessity. The type of material to be expected dictated what equipment and how much time would be needed if revetments would be required and if drainage would present a serious problem. Therefore it was of great value to know if one would encounter hard rock, impervious clays, or sand and gravel.

In the Moselle Valley a military geologist pointed out that bedrock was generally covered by just a foot or two of soil, making trench construction impossible except where the so-called Limon Formation was found. Therefore this formation was marked on tactical maps and used accordingly. Knowledge of the depth of the ground water table was also important, and when excavations were made without due regard for it, flooding often resulted.

Tunnelling was used in World War I to a degree never equalled before or since, and in this regard, geology again proved most helpful. At the battle of Sebastopol, the Allies quickly tunnelled

through a layer of soft shale after being initially slowed in their advance as they began the gallery in a layer of tough sandstone. It was by accident that the softer layer was discovered because a geologic study had not been employed. Such a study could have avoided the initial waste of time and effort. All along the western front, allied geologists identified areas where horizontal sedimentary layers would afford easy tunnelling and warned against areas where tough igneous rock would form a barrier or where ground water would be a problem.

As the war progressed, the Americans prepared new geologic maps to supplement older French and Belgian issues. Some of the maps showed only the general geology and the distribution of various types of rocks. Others were specifically designed to delineate areas where trench construction or tunnelling would be feasible. Before the end of the war, the American geologists had prepared 1:50,000 scale geologic maps of the entire western front to include much territory behind enemy lines. Additionally they were called upon to evaluate areas for troop movement, determine river bottom and bank conditions, fluctuation of stream levels, and for the first time, choose routes for advancing tanks (the forerunner of the modern trafficability studies). They also located urgently needed natural resources such as water and rock for macadam roads.

The American geologists produced eight special maps showing the surface distribution of suitable hard rock, the location of existing pits and quarries, as well as potential sources of sand and gravel. Due to the limited manpower and the broad scope of the task, maps and reports on locations of both surface and sub-surface water were scant in detail and covered only a portion of the theater. However, when possible, the geologists furnished information on the location of springs, areas feasible for shallow dug wells, areas of deeper sub-surface water, as well as available data on stream flow. Their maps also showed known wells and reservoirs and included data on water supplies developed by local towns.

By their performance on the western front, the geologists of the AEF and the other warring nations showed the vital role the knowledge of geologic conditions would play in modern warfare.

Just twenty-three years later when the United States once again went to war, American geologists again went with her. A total of 88 of our best found themselves working along with soils scientists and other specialists in a newly created organization, the Military Geology Unit. It was formed in June 1942 by a special agreement between the U.S. Geological Survey and the Corps of Engineers.



The complexities and geographic extent of the war made such an agency a necessity. It was charged among other things with identifying terrain suitable for use of armor and with selecting sites for new airfields. It was, in short, in the business of terrain intelligence. The bulk of the unit's work was done from Washington but in 1944 small teams went overseas and accompanied the Army into combat to assist in finding water, siting and constructing roads and airfields, and locating construction materials. These teams also checked the accuracy of predictions made in the rear before U.S. forces entered the hostile areas.

The main product of the unit was a series of "Strategic Engineering Studies" consisting of information and maps on rock types, soils, vegetation, water resources, rainfall, and locations of possible airstrips, roads, and construction materials. Most of this information came from library research and air photo interpretation. Immediate attention centered on the Pacific islands for which more than 120 studies were prepared. Later attention was shifted to North Africa and Europe. In addition to the generalized SES's, the unit prepared very detailed material, including terrain diagrams, trafficability studies, in-depth airfield

site selection, water supply maps, and construction materials maps.

Terrain diagrams, which give a true-to-life perspective of terrain features, were used to guide pilots bombing the oil center at Ploesti, Romania. Using only ordinary topographic maps, the bombers could not locate the heavily camouflaged facilities, but on a second attempt the realistic drawings enabled them to locate and destroy the site.

With the increased use of armor, trafficability studies became a necessity. Their compilation involved geologists, soils engineers, foresters, and others. Very often soil characteristics could only be approximated because they were based on knowledge of geologic conditions. In many respects the unit's work was the same as its World War I counterpart but on a greater scale and with more sophistication.

Learning a lesson from two world wars, the United States kept on with terrain intelligence work after the end of World War II. The Military Geology Unit was redesignated the Military Geology Branch (MGB) of the U.S. Geological Survey and supplied material to the newly formed Central Intelligence Agency for inclusion in a new series of strategic studies that covered the world.



These "National Intelligence Summaries" took nearly 20 years to complete.

The MGB also prepared a series of terrain analyses of selected military reservations in the Continental United States including Forts Benning, Campbell, Hood, and Knox, and an EIS covering the Sixth Army Area. Today the MGB is concerned with small, specific projects for other government agencies that include the Office of the Chief of Engineers for which it recently did a study on permafrost.

The pioneer work done in the field of terrain intelligence during World War II proved to be of great value in our recent experience in Vietnam. The techniques used at the Combined Intelligence Center, in Saigon, were similar to those used 25 years earlier — a combination of research, photo interpretation, and professional judgment. One of the severest tests of this system came in the preparation of terrain intelligence information to support the allied incursion into Cambodia in the spring of 1970.

Geologists, several of them members of the Corps of Engineers, played a significant role in this historic effort. Perhaps less spectacular, but significant, was the day-to-day work of soldier-geologists in the preparation of geologic maps,

trafficability studies, and other terrain related items. Terrain Detachments, working out of Long Binh, Nha Trang, and Phu Bai, transferred geologic data from French-made maps of the 1930's to 1:50,000 scale topographic bases. Geologists from these units also went to forward areas to help site airfields and roads, make observations to aid in preparing cross-country movement studies, and to locate quarries and borrow pits.

Again going back to World War II, during the Allied invasion of Europe, engineers were often called upon to "get the water off and the rocks on." But first someone had to find those "rocks." This mission of locating and exploiting rock deposits more often than not fell to the soldier-geologist. On June 8, 1944, just 48 hours after "D-Day" began, an Armored Engineer Battalion was operating a quarry on Omaha Beach. And 30 days later, other Armored Engineer Battalions were operating quarries all across western France to provide the mobility required by the armored spearhead.

Operations in the Pacific Theater during that period placed even greater demands on geologists because they had to locate sufficient construction material to support the island-hopping advance toward Japan. Conventional construction materials were virtually unavailable on most of the

Pacific islands that were chosen as airbases. So the geologist was called upon to locate coral in sufficient quantity for the massive runways, while the engineer sought methods of improving upon the basic qualities of coral to make it suitable as a construction aggregate. Since reconnaissance aircraft were at a premium, geologists from Aviation Engineer Battalions trained the pilots of single-seat fighters to conduct aerial engineer reconnaissance while on combat missions.

Later, when more aircraft became available, geologists themselves took to the air in an effort to hasten the location of construction material. In one instance, a geologist from the 836th Aviation Engineer Battalion spotted a deposit of 500,000 cubic yards of high grade coral while flying a "recon mission" over Saipan. Construction of a coral runway started there on June 15, 1944, and on November 24, 1944, B-29 heavy bombers took off to raid Tokyo. Similar significant contributions to military engineering by geologists were made during both the Korean and Vietnam Conflicts.

One of the highest priority missions given to the Corps of Engineers in Vietnam was the construction and upgrading of lines of communications (LOC). Vast quantities of rock in the form of aggregate were required, and geologists were tasked with locating, developing, and in many cases, actually operating quarries in support of the LOC mission. The record here speaks for itself — 27 million tons of aggregate was produced and 1456 kilometers of highway was constructed!

Today, the principal domain of geologists within the Corps of Engineers is in the Civil Works area. Still others are engaged in research and development efforts for the Waterways Experiment Station, the Cold Regions and Engineering Laboratory, the Nuclear Cratering Group, and other activities. Within OCE's Directorate of Civil Works, Engineering Division, is the Geology Branch from which a vast array of geologic talent is managed. The 15 men who occupy the Corps' top geologists' positions across the country have an average tenure with the Corps of better than 23 years. Their areas of expertise include such fields as arctic geology and permafrost, clay mineralogy, environmental geology, explosives excavation, formation design, remote sensing, and seismology and earthquake engineering.

The Corps' Civil Works activities continued, though at a reduced pace, even during the war years, but have steadily grown since the end of World War II. One estimate is that by 1980 as many as 500 geologists might be required to meet the Corps' needs.

The Civil Works program is presently or was recently engaged in more than 4,300 projects at a total authorized cost of 35-billion and appropria-

tions for new work totalled 16-billion dollars at the end of 1972. Geologists are frequently called upon during the course of these projects; especially when they involve stratigraphic or subsurface investigations. Recently, nearly 100 Corps geologists were involved in one single project; the Atlantic-Pacific Interoceanic Canal Study (1964-1971) which investigated 23 possible routes for a new sea-level canal across the American isthmus.

The Corps of Engineers has been an active participant in the new field of lunar geology. As early as 1960, the Military Geology Branch, under the direction of the Office of the Chief of Engineers, prepared a study and map of the surface geology of the moon. The text included a concise description of the various materials, information of landing and movement characteristics, as well as excavation and construction potential. Other geologic work progressed through the unmanned Ranger and Surveyor programs and continues today with the evaluation of the data from Apollo and the new Earth Resources Technology Satellite.

So we see that geologists of the Corps of Engineers have been a vital force in both war and peace. As we look to the future, we hope that their talents will be called upon to aid peaceful, construction pursuits. We must however be prepared for all possibilities. Therefore, because of the expanded use of geology in military applications over the last 50 years, the United States Army Engineer School presents instruction in this subject to various officer, non-commissioned officer, and enlisted specialist courses. A total of 11 hours of instruction is given to all students of the Engineer Officer Advanced Course, while enlisted Soils Analysts receive 22 hours of instruction which includes eight hours of field work.

Whatever the future may hold in store, geologists of the Corps of Engineers stand ready to meet the challenge!

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Captain Guy E. Miller

Murphy's Law states simply, "If anything can go wrong, it will." This natural law is one of the irrefutable facts of life. Murphy is the gremlin present in every human undertaking, always looking for some opportunity to disrupt a smooth operation. The military profession, primarily concerned with administering violence, is especially susceptible to Murphy and his law. In the military, with far more consistency than in the civilian world, when things go wrong the results can be tragic.

If we don't want to join Murphy, we have got to beat him. For this purpose, safety rules have been devised to frustrate his law. These rules have two main origins — experience and foresight. While experience may be the most effective teacher, in the demolition business it is also the most expensive. We just can't afford to let our people learn demolitions by their own mistakes.

In demolition training, safety is always given maximum emphasis. Right from the very beginning, everyone is taught the safety rules, and proper procedures are stressed throughout the training phase. Because of this attention, school and training environments have maintained almost perfect safety records. So our main concern is Murphy's success outside the school situation.

Murphy has two favorite victims for his dirty

work — inexperienced personnel and the very experienced — hence overconfident ones. In the military demolitions field inexperienced personnel are seldom a critical safety problem, primarily because of the tremendous emphasis on safety in their training. If anything, the inexperienced soldier is far more likely to be overly cautious.

However, in the combat support mission, inexperience and unfamiliarity can become a critical factor, not for the personnel handling the demolitions as much as for the troops they support. All too frequently in Vietnam, Infantry commanders, unfamiliar with the dangers of demolitions, failed to brief or account for their personnel properly, resulting in needless friendly casualties.

By far Murphy's favorite victims are the so-called "experienced" personnel. Why is this so? The safety rules are made to beat Murphy and they work. For the most part, everyone knows what the rules are and how to apply them. So every time someone gets hurt unnecessarily it is because an individual who should have known better ignored one or more of the rules.

Safety procedures are made to be completely Murphy-proof, closing off every loophole open to him. As people gain more experience they begin to learn that there is much more safety built into the rules than is required and they start cutting corners. But the often heard words, "It will

probably be OK," take on a special spine-chilling significance when the name of the game is "You Bet Your Life." The word "probably" announces an invitation to disaster.

If anything can go wrong, it will, but not necessarily immediately. Since Murphy frequently takes his time catching up, the practice of cutting corners grows into a habit. People decide they can get away with ignoring the rules and begin cutting more corners, compounding Murphy's opportunities. And sooner or later he takes advantage of this and strikes.

One particularly gruesome case happened at Fort Bragg, North Carolina, several years ago when a large number of experienced Special Forces personnel were training in a "demo" pit as 40 pounds of C-4 detonated, killing and wounding several men. Although the resulting investigation never conclusively established exactly how the accident occurred, the fact remains that if all the safety procedures had been followed properly, there would have been no such disaster.

The combat experience our soldiers rolled up in Vietnam has provided innumerable examples of the old adage that "familiarity breeds contempt." Many safety conscious, new arrivals, coming in-country for the first time, received the traditional, combat veteran's code from the old-timers. "No sweat. We don't bother with doing it that way here." But with Murphy around all the time waiting for his chance to strike, it is best to play it safe — by the book. For instance, a freak accident happened at a quarry near Cam Ranh Bay during the early years of the war that would never have happened if safety rules had been followed. A trooper was killed by a large rock when he stuck his head up to photograph an enormous blast.

As leaders, how can we go about beating Murphy's Law? Anything we can do to keep the odds in our favor rather than his will help frustrate him. Our first responsibility, obviously, is to insure that safety rules and procedures are properly followed. How many times in a tactical situation have leaders ignored safe principles by carrying caps and explosives together? It is true that usually nothing happened. But considering the possible consequences and the sad fact that Murphy was certainly lurking close by, was this a reasonable side to take?

Some procedures may seem silly in a combat operation but if they can prevent unnecessary friendly casualties there is no justification for disregarding them. For example, shouting, "Fire in the hole!" three times is never wrong.

Getting back to Murphy, another way to beat him is to use systems with maximum reliability. One example is to avoid the use of the time fuse wherever possible to set off an explosive charge.

Numerous techniques are available but perhaps the most reliable is to use detonation cord and electric caps as far as possible from the charge when setting it off.

Probably the most important thing for leaders to do if they are to beat Murphy is to constantly be aware of their troops and what they are likely to be doing or not doing. A good example of this involves an Engineer unit that was clearing a road of mines in Vietnam. As mines were located, they were blown in place and the resulting craters were filled before the unit could continue up the road. After several hours of this tedious procedure, the unit commander was horrified to see one of his men carry a mine he had just dug out of the road over to a vehicle and drop it on the hood, saying "Sir, we're tired of filling up those damn holes."

Not so fortunate was the troop who threw an ammunition crate into a pile of burning C-4. The resulting detonation unnecessarily added more personnel to Murphy's casualty list. Just as in the case of the soldier who was killed while photographing the quarry blast, the lesson shown here is that personnel are likely to get themselves hurt when they are not always made conscious of the dangers of demolitions.

Follow the safety rules and Murphy will never get his chance at you. Many safety rules are so obvious that to disregard them is ridiculous. Example: some time ago at Fort Belvoir, Virginia, a small automobile was damaged when its owner disregarded clearly posted warnings about minimum safe distance from a demolitions demonstration. Result: debris from the detonation crushed the parked car. Fortunately no one was near it when disaster struck.

Demolitions is considered to be a dangerous business. However, if proper procedures are correctly followed, there is no reason why "demo" should be any more dangerous than any other military program. If leaders will enforce established safety rules, employ systems with maximum reliability, and stay one step ahead of the troops, then Murphy will never have the opportunity to use his law to hurt our personnel or jeopardize our mission.

Captain Guy E. Miller is a recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia. He received a Regular Army commission in Armor from the USMA in 1969. Following Airborne and Ranger schools and AOBC, he served as a Platoon Leader in 1/17th Cavalry of the 82d Airborne Division. He graduated from the Rotary Wing Flight School in 1971, and following a branch transfer to the Corps of Engineers, completed a tour in Vietnam with the 1st Aviation Brigade.

THE KEY TO COUNTERMINE WARFARE

Captain Richard Kanda



Data released by the Office of the Surgeon General and R. H. Stolfi, Ballistic Research Laboratory (1972), indicates mines and boobytraps caused two percent of all U. S. casualties in World War II, four percent in Korea and more than 13 percent in South Vietnam. The percentage for Vietnam may be conservative.

A U. S. Army Mobility Equipment Research and Development Center office memorandum states that, "Many combat units in RVN had casualties (attributable) to mines and boobytraps of 30 to 50 percent, and approximately 80 percent of all vehicles destroyed were due to mines."

The literature about the seriousness of the mine threat faced by U. S. forces is replete with such statistics. So what has the United States Army done to counter this ever increasing problem?

In 1970, Department of the Army established a more formal, long term countermine systems development program. As part of this program, the United States Army Mobility Equipment Research and Development Center (USAMERDC) was designated Lead Laboratory for coordination and implementation of the entire program.

The USAMERDC response to this obligation consists of many ongoing research and development projects — all of which are oriented and controlled through use of systems analysis techniques.

This program is known as "Countermining System Definition and Analysis." It provides for the systematic organization and processing of all facets of the countermining effort. Previously, countermining hardware, doctrine and personnel were not systematically considered *en toto*. The total systems approach surfaced a new question concerning the mine detection hardware/personnel (equipment/equipment operator) interface. Just how much impact does the man using a portable mine detector have on the effectiveness of that mine

detector? The fact that an interface exists is obvious; but, how does one quantify it?

USAMERDC needed this information to truly evaluate its research and development projects dealing with hardware. It is an easy matter to measure the intelligence and state of training of the man. However, are these the only parameters worthy of investigation?

Before delving further in the countermining man/equipment interface, consider past experience where development of hardware was treated in a relatively singular manner.

Historically, countermining research and development has been predicated on the detection and/or neutralization of mines through use of hardware. In the mine-countermining confrontation, the miner has the advantage.

To illustrate, examine the family of man portable mine detectors. Detectors have been developed which sense metallic mines, nonmetallic mines, or the trace gases emanating from the explosive content of the mine itself.

The viability of the metallic mine detector is negated by nonmetallic mines. In turn, use of the nonmetallic detector is disrupted by enemy use of inert material which duplicates the signature of nonmetallic mines. Why not "sniff 'em out" with the trace gas detector? The miner just sprinkles the mined area with particles of explosives. The operator of the gas detector is then confronted with a veritable sea of mines. Will this vicious cycle of graduated technical response be broken? Realistically, probably not.

There has been no appreciable gain in U. S. countermining effectiveness since World War II. Field commanders need not hold their breaths for that single technological breakthrough. The enemy miner will always have the advantage. He may be forced to use a technically inferior mine. However, just the knowledge that the mine is

emplaced at a certain location assures the miner of his historical edge.

Reliance on perceptual detection of mines by man is empirical fact. Reports from South Vietnam and previous conflicts indicate that 70 percent to 80 percent of all mine detections are attributable to unaided personnel.

In the past, combat troops have received a modicum of training in countermine techniques. This training was based on techniques proven by past experience. However, no concerted or formal effort was made to identify and train specific individuals with exceptional ability to detect mines. Such individuals do exist.

Query any combat soldier who operated in an area the enemy actively mined. He will invariably relate a war story concerning some individual who was most adept at locating mines.

What makes some individuals more effective? Is it basic intelligence or innate practicality? Is it an inherent or acquired skill? Is it his visual search mode? Exactly what are the parameters embodied in a man who is an effective mine detector? Is it possible to quantify those parameters?

USAMERDC commissioned the Human Resources Research Organization (HumRRO) in 1972 to answer these questions. The initial scope of the task was to derive a more formal empirical base.

The HumRRO approach was to test and interview 78 combat veterans. Criterion for selection was based on the proven proficiency of the test subjects as mine detectors. They were nominated by peers and superiors who verified proficiency during personal association with the men in combat. The test subjects came from infantry, armor, mechanized infantry and engineer units.

Evaluation of the empirical base established by HumRRO (August 1972) indicates the following for highly expert subjects: They relied on unaided means (visual or tactile) 80.6 percent of the time to detect mines. Use of a mine detector accounted for only 5.6 percent of the time. A very high number, 97.2 percent of the subjects, reported use of a "special feeling" (emotional reaction) which seemed to warn them of danger. Interestingly, subsequent detections or enemy contact confirmed the validity of the special feeling 65 percent of the time. While moving at the normal speed of their unit, over 80 percent felt confident or very confident of their ability to detect mines. Infantry subjects indicated that dogs (40 percent) or a small, light mine detector (27 percent) would be the best way to augment unaided means of detection. Significantly, they wanted dogs or detectors only as a supplement — not as a replacement for the unaided method of mine detection.



All subjects were requested to make recommendations or comments concerning mine detection. A high percentage felt that individuals with exceptional aptitude for mine detection could be identified. They recommended more realistic training be instituted. They felt that tracker-type training would be beneficial.

In late 1972, on request and contract by USAMERDC, HumRRO turned from its study of experienced personnel. A total of 104 combat naive individuals (recent AIT graduates) were investigated to develop, quantify and validate parameters involved in the human detection of mines. Results were identification and validation of human characteristics indicative of high aptitude for unaided detection of mines.

The conduct of this research was prefaced by extensive questioning and testing of the subjects to develop theoretical predictive measures. Predictive measures were preconceived to be grouped as follows: physical characteristics, personal history, personality characteristics and native aptitude.

The following factors were considered in detail. Visual acuity was tested. A personal history was taken with emphasis on prior countermine knowledge and level of civilian education. Personality characteristics were noted by formal testing of individual dogmatism, manifest anxiety, team orientation and stress resistance. Individual awareness factors or native aptitudes in the area



of visual stimulation/reaction were tested.

After the inventory of information was completed, the subjects were taken to a field site for proficiency testing. Prior to going through the test lanes sown with all types of mine and booby trap simulators, the individuals were given a briefing. They were reminded of previous training received in AIT on detection procedures. Next, specific information on the devices and employment techniques used in the test lanes was given.

The specifics given were an approximation of the intelligence a soldier would likely receive prior to a combat operation. The subjects were then allowed to proceed individually down the lanes. They proceeded at their own speed. HumRRO observers evaluated the performance of each test subject.

Test result evaluation by HumRRO (May 1973) indicates that, "the highly proficient (combat naive) detector can be characterized in the following manner: During the test he spent more time and expended more effort; he graduated from high school (and) completed more civilian education; he was less dogmatic (more open-minded); finally, his visual acuity was better than that of less proficient detectors."

What conclusion can be drawn from the preceding? Man is the key to countermining warfare. Man in this context is not the operator of a sophisticated detection device. Unaided man has been and will continue to be the most efficient, cost

effective mine detector in our inventory. With judicious application of recently acquired knowledge, new orientation in doctrine and training should be developed.

A recent change in doctrine fits nicely. Countermining effort has been a traditional responsibility of the Corps of Engineers. Revised doctrine now states that the combat arms as well as their supporting combat engineers must take deliberate countermining measures in the field.

What about the soldier? Individual soldiers should be identified early in their careers as possible mine detectors of high effectiveness using the HumRRO battery of tests as a basis.

Once the individual is identified, he should receive detailed, realistic training. The end result would be an individual with high detection proficiency who was not developed through a bloody trial and error process on an actual battlefield. This soldier should be awarded recognition in the form of a specific military occupational specialty (MOS). The MOS should be secondary in nature or be a suffix much like those awarded to airborne qualified personnel. He should be assigned a primary MOS in the combat or combat support arms. Developmental work should be initiated to specifically equip him for his duties. Possibilities are special vision devices, more compact detectors, lighter weapons, more use of dogs and better body armor.

It is not proposed that unaided man displace the other elements of countermining warfare, i.e., materiel and technique. It is proposed that his presence be optimized — that his role be upgraded from that of an equipment operator or visual observer endowed only with broadbrush training and that he be selected and trained through use of definitive criterion statements. In this way the historical edge of the enemy miner may be trimmed to an acceptable limit.

Captain Richard Kanda is a recent graduate of the Engineer Officer Advanced Course At Fort Belvoir, Virginia. Commissioned in the Army after graduation from the Colorado School of Mines in 1967, he has served both overseas and in the U. S. Captain Kanda was first assigned to the 24th Engineer Battalion, 4th Armored Division in Germany as a demolition platoon leader and as a company commander from 1967 to 1969. He also served in Vietnam later in 1969 and 1970 as a Company Commander with the 20th Engineer Battalion (Combat), and the 937th Engineer Group (Combat) as Assistant S3. A graduate of the Colorado School of Mines, he was an Instructor and Senior Instructor, Nuclear Weapons Employment Division, at the U. S. Army Field Artillery School, Fort Sill, Oklahoma, from 1970 to 1973.

SOVIET RIVER CROSSING TACTICS

Captain Richard E. Ashby

The Russians are not at all inclined to look upon rivers as insurmountable barriers that limit a commander's freedom of action. On the contrary, they attach remarkably little importance to the difficulties that are involved in crossing rivers with troops and equipment during combat operations.

It would be fallacious to assume that this attitude is adopted only toward rivers with special characteristics that tend to facilitate crossing operations. This was demonstrated when the Russians crossed the flooded lower reaches of the Oder, a typically Central European river and on other occasions during the winter of 1941-42 and the fall of 1943.

The Russians never use a river as a phase line in offensive operations. Even if they are unable to carry the attack forward across the river, they immediately send forces ahead to assure the establishment of small bridgeheads for subsequent operations. By moving mobile troops rapidly forward, they endeavor to cross the river before the enemy has had a chance to bolster his defenses.

These tactics did not originate with the Russians. It has always been the aim of attacking forces to cross a river prior to or simultaneously with the defeated enemy troops, unless it has been preplanned to halt operations upon reaching the river.

The distinguishing feature of Russian tactics is the fact that as a result of their mass commitment of troops, they are in a position to launch attacks simultaneously on a wide front and to over-run all undefended areas. This technique enables them to quickly discover and swiftly cross any sectors that are not defended or are held by weak enemy troops.

Tactically speaking, the Russians are adept in all types of crossing operations that include infiltration to major offensives, moving forward of advance attachments, and large-scale nighttime crossings.

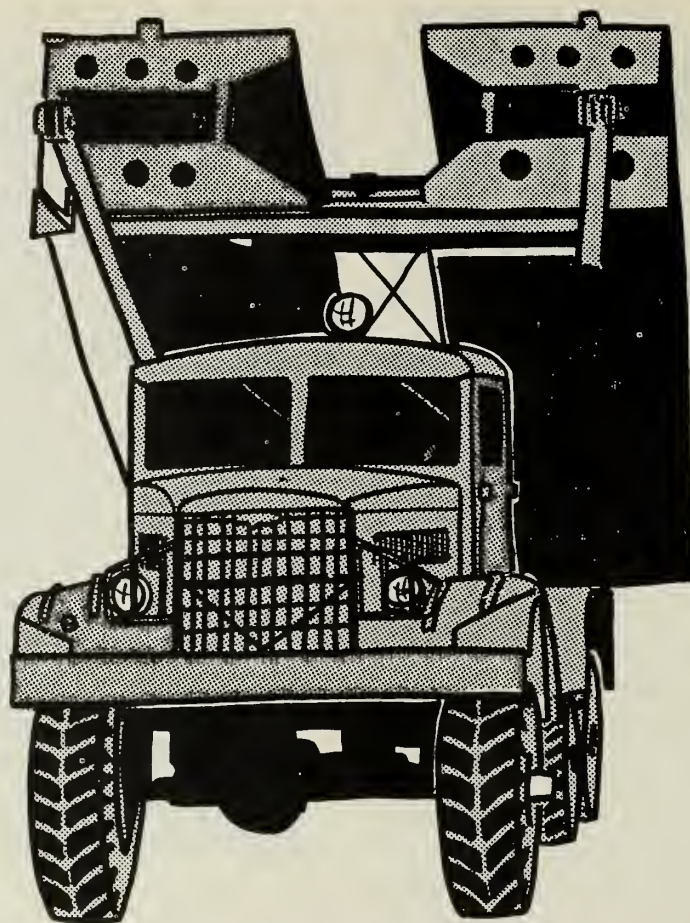
The Russians are no more deterred by difficult terrain and river conditions than by unfavorable weather and seasonal changes.

In World War II, the Russians did not employ any startling technical innovations in crossing large rivers. The devices they used were relatively primitive, but effective.

It is reasonable to assume, however, that the Russians have since perfected their crossing equipment to such an extent that they can cope with the problems presented by Central European Rivers.

Special attention should be called to the fact that the troops are resourceful and well-trained in crossing techniques.

All in all, it is imperative for defenders of a river line to remember that the Russians are able



to recognize and exploit. This evaluation of Russian river crossing capabilities was the result of a post-World War II study that received the full endorsement of Generaloberst A. D. Franz Halder, Chief of the German Army General Staff.

As a result of successful broad-front, river crossing operations during WWII, the Soviets have concentrated on the development of bridging equipment that would enhance this technique. Today, more than ever, it is vital that armored and mechanized infantry mobility be restricted as little as possible by terrain features. Therefore, the Soviets place emphasis on the co-development of armored and engineer equipment. This ensures that sophisticated and advanced engineer equipment is available to properly support their newer, armored and mechanized vehicles.

Soviet Engineer Tactical Bridging has emphasized three basic design principles: 1) speed of construction, 2) simplicity of design and, 3) minimal additional construction support.

With these concepts in mind, in 1961, the Soviets developed and introduced the Heavy Folding Ponton Bridge, PMP, into their engineer inventories.

Designed to carry Class 60 loads, the PMP float bridge has a construction rate of 60 feet per minute and requires a construction crew of ap-

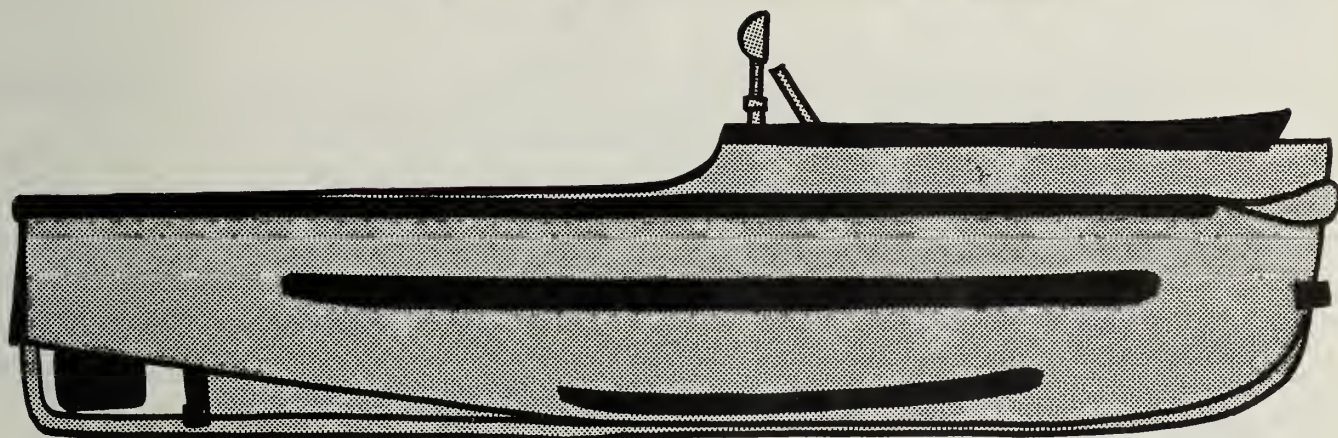
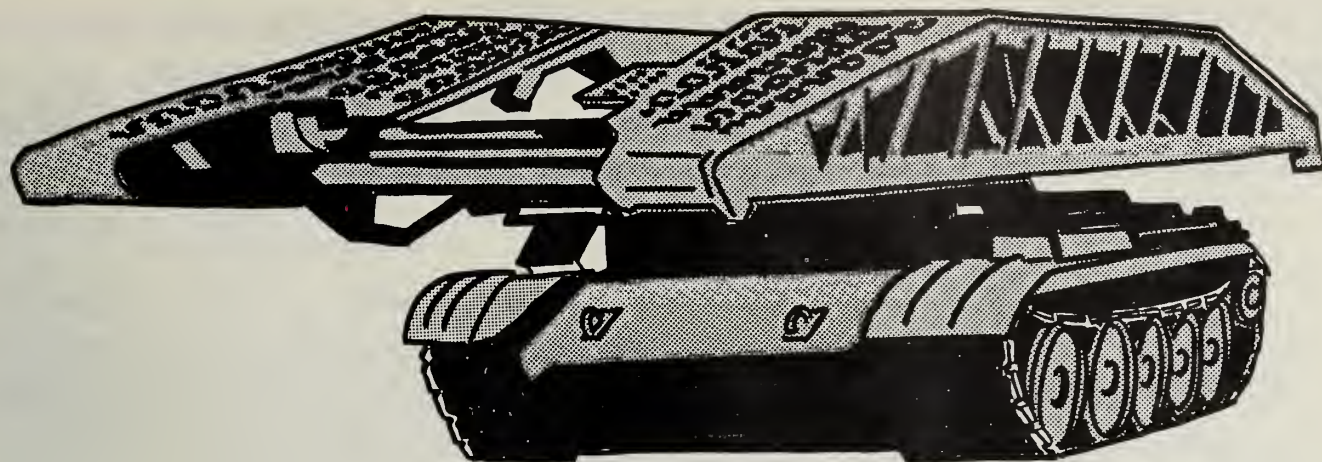
proximately 35 personnel. Consisting of 16 center pontoons, two end or ramp pontoons, and one anchor/repair truck, the PMP Set has a spanning capability of more than 320 feet. Each ponton is a self-contained, mechanically operated unit with the ponton superstructure serving as the roadway surface.

The KRAZ-214 Truck transports, launches, and retrieves the folding ponton.

To minimize the requirement for additional supporting construction equipment such as cranes, the Soviets developed the BMK-150 Power Boat with integral travel struts! These struts are folded along side after the boat is afloat.

The Bridge Erection Boat is used in conjunction with PMP bridging and rafting operations. Using a traveling arm connected to the AFT section, the BMK-150 is towed to the bridge site by a KRAZ-214 vehicle. Upon arrival, the truck backs up to the river's edge and pushes the boat out into the water. A crew member disconnects the traveling arm which releases the integral strut-locking devices. The wheels swing forward into storage wells and the boat is ready for operation.

While the U. S. has eliminated the need for a crane in bridge construction by developing a ribbon bridge. A crane or lifting vehicle is still required for our sectionalized bridge erection



boats. Perhaps we should consider developing a new bridge erection boat that would compliment our Ribbon Bridge set.

To provide Engineer support during the assault phase, the Soviets have developed and introduced the Tank-Launched Bridge MTU. This class 60 bridge span consists of two box-truss treadways mounted on and launched from the T-54 tank chassis.

The cantilever launching technique was specifically used to minimize the bridges exposure to enemy fire. In addition, the span is launched by a mechanical drive system rather than a hydraulic one. The primary short coming of this bridge is its limited spanning capability of only 40 feet. Therefore, the Soviets will probably develop a similar bridge with a greater spanning capability.

To improve their bridging versatility, the Soviets have developed and introduced into their Engineer Inventory the Heavy Truck-Mounted Scissors Bridge. This bridge consists of at least three (3), class 60, 30-foot spans mounted on a modified KRAZ-214 Truck. Using a mechanically driven launching arm and cable system, the span is raised to the verticle position. The cable system unfolds the bridge and begins to lower it into place. While the bridge is being lowered, the adjustable trestles that are mounted beneath the

span, are released and locked into position. When the lowering operation is completed, the span is married to a previously emplaced bridge section. The intergal trestles can be adjusted up to 10 feet in height. However this limitation could be overcome easily by cribbing beneath the footers.

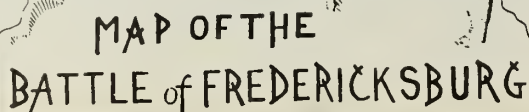
With a construction crew of 12 personnel, this set can be erected over a 100-foot dry or wet gap within 45 minutes. To increase this spanning capability, two TMM Sets could be employed together.

As you can see, the Soviet Army Engineer units are equipped with modern, sophisticated, tactical bridging to ensure that they can provide the necessary support to their armored and mechanized infantry units. They have had more than 10 years to gain the necessary experience to understand its capabilities and limitations. Therefore, the Soviet Engineer's capability cannot be passed over lightly.

With the modern concept of nuclear tactics and its emphasis on battlefield mobility the advantages of having this type of bridging equipment available is self evident.

Captain Richard E. Ashby is a former graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia.

A detailed black and white engraving depicting a large-scale river crossing operation. In the foreground, several large wooden wagons are being pulled by teams of men across a muddy bank. In the middle ground, a large number of men are wading across the river, carrying long poles and other equipment. In the background, a large stone bridge is visible, and a hillside with buildings is on the left.



DECEMBER 13TH 1862.

On November 7, before McClellan's plan materialized, he received an order from the President relieving him and appointing General Ambrose E. Burnside as commander. After Burnside had



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PLANT WORK!

taken formal command on the 9th, General Halleck, General-in-Chief, requested that he submit a plan of operations — that same evening Burnside forwarded his plan. He was going to give up the Orange and Alexandria Railway as his line of communications; make Aquia Creek his base for supplies; make the enemy believe he was going to attack Culpepper but instead move his whole force to Falmouth; cross the Rappahannock River and take Fredericksburg before the Confederate force could concentrate, and then continue to his objective — Richmond.

For this operation Burnside requested that a wagon train of subsistence stores, preceded by a train of pontons, "enough to span the Rappahannock with two tracks," be dispatched from Alexandria to Falmouth. He also requested that provisions and forage be sent to Aquia Creek.

Burnside's plan received Presidential approval on November 14. His first step was to reorganize the Army of the Potomac into three Grand Divisions and a Reserve Corps. Each Grand Division was made up of two Army Corps.

On the morning of the 15th, the Right Grand Division under General Sumner started for Falmouth and arrived there on the 17th. The other two Grand Division followed a day or two later. But the Army could not cross Rappahannock — there were no pontons!

One might rightly say that it was here that the Battle of Fredericksburg was lost; however, I am of the opinion that the battle was lost when Burnside made his request for pontons. He, like McClellan, had been under political pressure to move at once. Without requesting the bridging to be forwarded to him at Warrenton or either waiting to be sure that it was on its way to Falmouth, he started his move, a move entirely based on surprising the enemy and which required the ability to rapidly cross the Rappahannock. In other words, this was an operation wholly dependent upon the bridging capability of his engineers; a capability impossible without pontons.

The story of the pontons is an interesting one to investigate. In General Halleck's report, he wrote:

"It has been inferred from the testimony of General Burnside . . . that his plan of marching his whole army from Warrenton to Falmouth had been approved by the authorities in Washington, and that he expected, on his arrival there, to find supplies and pontoons . . . That plan was never approved . . ."

"It was alleged at the time that the loss of this battle

resulted from neglect to order forward the pontoon trains from Washington. This order was telegraphed by me from Warrenton to Brigadier General Woodbury, then in Washington, on the 12th of November, and was promptly acted on by him. General Burnside had supposed that the pontoon train was then in Washington or Alexandria, while it was still on the Potomac, at Berlin and Harper's Ferry . . . General Burnside had only allowed time for transporting his pontoons from Alexandria . . ."

General Burnside stated in his report that when his plan was submitted to Washington, General Halleck telegraphed him to meet for a conference on the 12th of November, at Warrenton. At this meeting, General Halleck agreed to give his attention to everything required for the operation; and "that he would at once order, by telegraph, the ponton trains spoken of in the plan, and upon his return to Washington, see that they were promptly forwarded." On the 14th Burnside received a telegram from General Halleck stating that the President had approved his plan.

On that same day, November 14, Burnside was notified that Captain Ira Spaulding had arrived in Washington with 36 pontons and 40 more were expected the next day. One ponton train was scheduled to start overland toward Falmouth on the 16th or 17th. Apparently, this notification was what prompted Burnside to start his move on the 15th from Warrenton to Falmouth.

On November 17, the same day that General Sumner arrived at Falmouth, Burnside was notified that the ponton train had not been able to leave Washington.

The following day, November 18, Burnside was notified that "Major Spaulding (apparently he had been promoted) has been delayed in obtaining harness, teamsters, and etc., for 270 new horses. He expects to leave tonight." However, the train did not get off until the afternoon of the 19th.

As Major Spaulding pushed his overland train, it commenced raining and the roads became very bad. Upon arriving at Occoquan Creek he decided to raft his boats toward Aquia Creek and send the animals overland. He arrived at Aquia Creek with the pontons on the 24th, teamed the wagons, and by nightfall of the 25th arrived at General Burnside's headquarters.

When General Sumner arrived at Falmouth (17th), Fredericksburg was weakly defended. General Lee was surprised at Burnside's move, but had considered it a possibility and previously

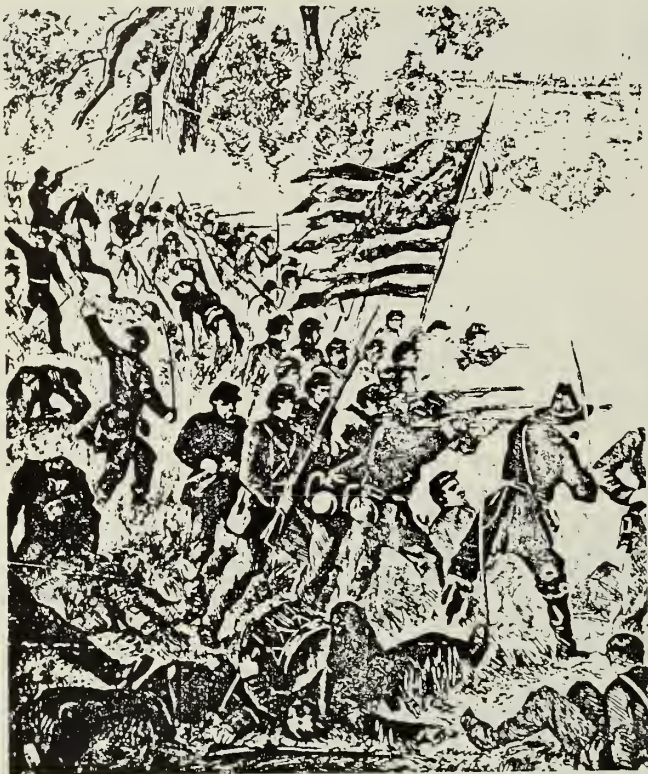
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ordered the bridge from Aquia Creek destroyed. On November 18, Lee confirmed the movement of Burnside's entire army by a report from General Stuart, and ordered McLaw's division of Longstreet's corps to Fredericksburg. The next day the remainder of Longstreet's corps headed for Fredericksburg and the entire corps closed there on the 21st, while Burnside's Army watched from the north side of the river.

To the military student it is interesting to note how Lee combined his army for the battle and the fact that he had not originally intended to resist at Fredericksburg. In a letter to General Jackson on November 19, Lee wrote:

"It is certainly important to deceive the enemy as long as possible as to our position and intention, provided it is rendered certain that a junction can be made before a battle; and this latter point we must always keep in view as necessary to enable us to resist the large force now on the Rappahannock. As to the place where it may be necessary or best to fight, I cannot now state, as this must be determined by circumstances which may arise . . . Longstreet's corps is moving to Fredericksburg, opposite the place where Sumner's corps has arrived. As before stated, you can remain in the Valley as long as you see that your presence there cripples and embarrasses the general movement of the enemy, and yet leaves you free to unite with Longstreet for a battle . . . I shall wait to hear again from Stuart today and will then start for Fredericksburg if circumstances warrant."

Had Burnside's plan succeeded in surprising Lee, the general would probably have made his main defense behind the North Anna. Because of Burnside's hesitation, Lee resolved to stop him on

the north bank of the Rappahannock and cause him to make another change of base, or to stand fast until winter suspended his operations. I believe either of these events would have caused great dissatisfaction in the North, as well as a retreat.

In consolidating the Confederate army, Lee had given Jackson the extreme limits of discretion; not ordering him to join Longstreet until November 27. Jackson displayed, once again, his dependability and swift movement by joining Longstreet on the 30th, while Burnside still hesitated. At this point, the Army of the Potomac, containing approximately 122,000 men, faced Lee's army of 78,000 Confederates over a river 400 feet in width.

As previously mentioned, the pontons had arrived on November 25, but Burnside seeing his surprise plan defeated, hesitated and searched for another place to cross. He had to do something as the press and political pressure demanded action. He figured he must force a crossing at Fredericksburg, or, by maneuvering, turn Lee's position and cross the river elsewhere. He made preparations, on December 1, for a turning movement by way of Skinker's Neck (12 miles south of Fredericksburg), but the appearance of D. H. Hill's division on the southside of the river caused him to abandon this project. Burnside finally decided to cross at Fredericksburg in front of Lee. He reasoned that Lee's line was too far away from the river to make any effective resistance to the actual passage of the river and that the real fight would be made after his army got across. Another factor in this decision seems to have been misinformation, some of which was obtained by balloon observation, whereby Burnside thought Lee's army was stretched over a long distance, guarding the river crossings below Fredericksburg.

Burnside's plan of crossing was to span the river with five ponton bridges, three opposite Fredericksburg, and two just below the mouth of Deep Run. To accomplish this mission, two engineer organizations were available to Burnside: the Engineer Battalion, a Regular Army unit commanded by Lieutenant Charles E. Cross, and the Volunteer Engineer Brigade commanded by Brigadier General Daniel P. Woodbury. (General Woodbury was also the Army Chief of Engineers having served in that capacity since 1836. He would continue to serve as the Chief until he was killed near the end of the war in 1864). The Volunteer Brigade consisted of two regiments, the 15th and 50th New York. The Engineer Battalion (Regulars) and detachments of the 15th New York Regiment, under Major James A. Magruder, were directed to construct the two bridges downstream with the upper three bridges to be thrown by detachments of the 50th New York Regiment, under Major Ira Spauling.



Pontoon bridges are built by placing decking (balk to engineers) between floating pontoons (boats). The balk spans from ponton to ponton and is secured to the pontoons by lashings. The pontoons used during the Civil War were simple wooden row boats transported by flat-bed wagons. Balk was undressed lumber two inches or greater in thickness. The pontoons were launched and floated into position and the balk was laid. The bridge was built by consecutive float from near shore to far shore and anchors were used on every second or third ponton to hold the bridge in place.

Construction of the bridges was not an easy task, particularly the three bridges opposite the town. Lee's artillery was placed on the hills above and to the rear of Fredericksburg and could not sweep the upper bridging sites without damaging the town. However, General Barksdale's Mississippi Brigade had been positioned in houses, cellars, and rifle pits in front of the three crossing sites. Although the Rappahannock River was only 400 feet wide and the Confederate artillery could not fire through the town, Barksdale's troops would make the crossings costly. General Hunt, Burnside's Chief of Artillery, massed 147 guns on the high bluffs above the Rappahannock to support the crossings and a regiment of infantry was assigned to each of the bridge detachments as a

security force.

During the early cold hours of December 11, the operation commenced. By 3 a.m., bridge trains were in position along the east bank of the river. At 6 a.m., it looked as though the upper crossings would be a success. Major Spauling and his 50th Engineers had two of the bridges two-thirds of the way across and the other one-fourth of the way. Suddenly, the Confederates, from their well-concealed positions, opened up with terrific fire upon the engineers who were working approximately 80 feet from the water's edge.

Burnside covering forces were ineffective due to the range of the infantry fire and a thick fog that made targets difficult for the artillery. Although several barrages were laid by the artillery batteries, the Confederates would emerge from cellars and trenches after each barrage and pick off the engineers as they resumed their work. General Barksdale told one of his messengers to "tell General Lee that if he wants a bridge of dead Yankees I can furnish him with one." Until Barksdale's men could be driven off, the work would remain at a standstill.

Work on the lower bridges at the mouth of Deep Run had been hampered by the cold and ice, but by 7 a.m. when the bridges were nearing the far shore, the Confederates opened fire. Lieu-

eroy's Trusses.

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ant Cross lost three men — one wounded and one taken prisoner. As Major Magruder's men were laying the balk in the last bay of their bridge, they also were attacked. This resulted in six casualties and damage to several pontons. Then the Union's artillery opened fire on the Confederates and repelled further attacks. By noon, both bridges were completed with neither the Regular Battalion nor the 15th New York receiving serious position.

At this time, with the upper bridges still at a standstill and Major Spaulding's engineers suffering casualties, Burnside called a staff meeting with Woodbury and Hunt. At this meeting, it was decided to ferry infantry across in the ponton boats to pry the Confederates loose from their strong holds. The engineers ferried 120 infantrymen of the 7th Michigan across the river, followed by 100 men of the 89th New York. As the infantrymen landed ashore, a scrapping fight took place that forced the Confederates to fall back through the town. The bridges were then quickly finished by the engineers, and that evening Burnside's Grand Divisions marched across.

On the morning of December 12, Fredericksburg was occupied and by nightfall the Army of the Potomac was ready for battle. Burnside attacked Lee the next day but failed to dislodge him. After several futile charges against Lee's position on Marye Heights and 12,600 casualties, Burnside ordered his troops to recross the bridges the 11th. When they had crossed, the engineers dismantled the bridges.

Fredericksburg had been a testing ground for the combat engineers. The mission was accomplished in spite of cold weather, ice, and enemy fire. The casualty rate had been relatively high, particularly in Major Spaulding's unit. In the opinion of several of the high ranking officers, the Engineers had not stood up to the Confederate fire as they should. Even General Woodbury was displeased at first but after he visited the far shore and had a better understanding of what the situation, he wrote:

"I was greatly mortified in the morning to find that the pontoniers under my command would not continue at work until actually shot down . . . Perhaps I was unreasonable. I found a loop-holed blockhouse, uninjured by our artillery, directly opposite our upper bridges, and only a few yards from their southern abutment. I also found in the neighborhood a rifle-pit behind a stone wall, some 200 feet long, and cellars inclosed by heavy walls, where the enemy could load and fire in almost perfect safety. There were many other secure shelters . . . It is generally considered a brave feat to cross a bridge of any length under fire although the time of danger may not last more than a minute or two. How much more difficult to build a bridge exposed for hours to the same murderous fire, the danger increasing as the bridge is extended."

Burnside's report of the battle included the following statement about his engineers: "No more difficult feat has been performed during the War than the throwing of these bridges in the face of the enemy by these brave men. It was a gallant work."

In my opinion, Burnside's decision to send infantry across in ponton boats to secure the far shore has led to present military river crossing doctrine. No bridging effort could now be attempted as Burnside attempted it in the Civil War. A small unit of well concealed men with modern weapons could prevent any amount of men from building any type of bridge across a 400 foot gap in this day and time, if attempted as Burnside did initially.

Present day river crossings are conducted in two phases —

- Infantrymen are ferried across in pneumatic assault boats by engineers to secure a bridgehead. It is hoped that the first wave will surprise and catch the enemy off guard. However, this is not always possible. Once the infantrymen have secured the bridgehead, the engineers begin building footbridges to allow more infantrymen to deploy across. Small vehicle rafts also are used to carry support vehicles and ammunition across the water.

- As the infantry continues the fight and expands the bridgehead, the engineers begin the second phase — that of constructing the large ponton bridges capable of carrying the heaviest divisional loads.

The Combat Engineer of today is the same soldier as his counterpart at Fredericksburg. The type of bridging equipment has changed but he still works with pontons and balk and must expose himself to fire.

Combat Engineers are some of the U. S. Army best soldiers. They performed many courageous feats throughout the Civil War and have continued to perform them throughout the years. Of many tasks that they have performed, words like General Burnside's have been said again and again — "IT WAS A GALLANT WORK."

Major Alfred H. McDonald has served in a number of engineer positions in this country and overseas. He was with the 70th Engineer Battalion (Combat), the Second Republic of Korea Army, 9th Log Command (Thailand), Electronics and Special Developments Branch, U. S. Army Combat Developments Command Infantry Agency, Headquarters, Long Binh Post, and the 4th Infantry Division. He has attended the Engineer Officers Career Course and holds a Masters Degree in civil engineering from Texas A&M University.



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Guardians of the Past

CPT John R. Mullin

The Cathedral, the Danube and Albert Einstein are the features and characters that come to mind when speaking about Ulm and Neu Ulm, Bavaria.

Yet there is a unique feature in these twin cities that is of monumental scale and of which U. S. Army Engineers serving there are virtually unaware.

This is the group of historic fortresses that ring the two cities. From their construction between 1841 and 1859 and in the present day engineers, these forts have played an important role in the life of the two communities.

They have served as garrisons for the Bavarians and Germans and prison camps housing French and Russians. The forts have also served as detention camps for ex-Nazis, centers for the

socially deprived, homes for the modern Bundeswehr and havens for "hippies."

One of these fortresses, Ludwigsvorveste, is at Wiley Barracks which is used for ammunition storage. To the privates who guard this site, the fortress means a night of coldness, weariness and boredom. But to the historian of military architecture, the site is of great significance because of its design, history and perfect structural condition.

In late 1969 the German Government proposed a highway plan which would have partially destroyed the fort at Wiley Barracks. The author in his capacity as a community planner for HQ-USAENGCOMEUR was responsible for developing an alternate scheme which would allow for rehabilitation of the fort. It was accepted.

There are several legends and stories concerning this particular fort and the entire system of

forts in general. Americans who have followed the Bavarians, French, Prussians and Germans as occupants of "Ludwigsvorfeste," have the impression that the fort is Napoleonic. "Yep," said a master sergeant, "Old Napoleon came right through here on his way to the Battle of Ulm against General Mack and the Austrians."

Actually, the fort was built by Ludwig I of Bavaria in 1848 as part of a common defense agreement among the German states. The agreement was aimed at thwarting a possible future French offensive against southern Germany. The German strategists felt that all attacks would be aimed at Munich and the easiest approach to the city lay between Karlsruhe and Strasbourg toward Ulm, and the defenses of Ulm and New Ulm grew out of this planning.

Miles of tunnels run beneath these forts and they are the source of several legends. Rumors circulate about the "booby trapping" that the Germans supposedly arranged during the last days of World War II. But an investigation of five miles of tunnel uncovered no evidence that this was a fact. Nevertheless, the tunnels are not the safest place in the world. The gate guard at Wiley commented, "There ain't no way I would volunteer to go down there." The tunnels are crumbling in some parts and maze-like in others.

Other rumors concern the extent and design of the passageways. Most of the German community believes that they were interconnected at one time or another. Since the aerial bombardment of the war caused many of the tunnels to collapse and plans of the complex are incomplete, proof is hard to come by. The Bundeswehr post engineer at Fort Wilhelmsberg, one of the nine original forts, insists they were connected. Herr Helmut Pflueger, the city historian and expert on fortifications, feels this was impossible because of the sharp differences in land forms at relatively short distances. These tunnels are so wide in some parts that a platoon could march en masse without difficulty.

Herr Pflueger, based on 25 years of research in the area, suggests that the tunnels were to have been used by engineer sapper troops to set explosive charges under the advancing enemy. The massive tunnels were constructed from the center of the fort in a star-shaped pattern 100 meters into the fields of fire beyond the moats. During the periods when a battle was about to begin, the sappers would be sent into the tunnels to listen. When they could hear the enemy, a new tunnel, perpendicular to the main tunnel, would be dug about 10 yards deep. After the charge was set, they fled as far as possible, for with the problems of timing charges then, the risk of injury was quite high. Then too, you could never be sure





that the enemy might not be countermining your own tunnel.

These tunnels extend for miles under the forts. Some are filled with bats and vermin. In the deepest tunnel, stalactites are growing on the ceiling. On the same level as the stalactites, a room carved out of rock was found with a CARE package dated 1947, evidently left by displaced persons who used these tunnels for shelter.

Of the nine forts, Wiley Barracks is in the best condition, while others, including the Illir Kanal Fort and Fort Albeck, have been allowed to deteriorate. Fort Albeck probably has the most interesting heritage of the complex. Built on the site of an earthen fort occupied by the Austrians during the battle against Napoleon, it was partially destroyed by Allied airpower in World War II. After the war, it served as a detention camp for Nazi officials, a home for displaced persons, a home for the socially deprived and as a safe harbor for the "down and out." Coupled with the still visible war damages, the drifters, hippies, bums and alcoholics give this fort a surreal aura.

What a story one of these forts could tell of the history of Europe in the last 170 years. If we can give one of them, Fort Albeck, a voice for a moment . . . "I am Albeck. Built on the grave of another fort that was razed by Napoleon, I have protected, destroyed, served as a haven and a hell.

"I have commanded this hill against Frenchmen, Italians, Prussians, Austrians, Englishmen and Americans . . . occupy me and I will serve. My walls have muzzled the outspoken, aided the oppressed, sheltered the poor, protected my occupants and forced my enemies to go elsewhere.

"I, the previous fort on this site, and my brother forts have served Napoleon, Ludwig, Hindenburg, Kaiser Wilhelm, Bismark, Hitler, Patton Adenauer and Brandt. I, created for death, have lived. I am happy now for I am more needed than ever. I still hear crying, but now it is crying born of relief and joy, for today I house those who have no other place to go. I am their new beginning."

Captain John R. Mullin is a professional city planner who served as chief of master planning at HQUSAENGCOMEUR from June 1970 through July 1972. During that period he researched the 14 post-Napoleonic Forts that surround Ulm, Bavaria and found they have been at least peripherally involved in wars from Napoleon through the Cold War. He left active duty as a captain in December, 1972 and is now both in the Reserves in Buffalo, New York and a Ph.D. candidate at the University of Waterloo, Ontario, Canada

TROOP TRAINING

Captain Leonard J. Jagoda, Jr.

Recent legislation has introduced new laws and government agencies to protect our environment. These new tools will help curb the disastrous effects of poor management and help protect our country from being destroyed by its own enthusiasm. But for many areas of our country these efforts have come too late. An example of this is the effects of strip mining on our environment. As of 1965 the United States Bureau of Mines estimated that surface mining had used 3.2 million acres of land. At least ninety per cent of this acreage had been mined using the 'strip-mine' method. Two-thirds of this acreage requires reclamation. These 2.1 million acres are not only unsightly but an even more alarming consequence has been imposed on our critical water resources. Many of these abandoned mines leave iron sulfides exposed. When these sulfides mix with water they form sulfuric acid, which drains into our streams. The hazardous affects on these streams are not 'immediate' in terms of time or location. The tributaries which have not as yet, will eventually disturb our larger water sheds.

The mining industry has, in certain locations, reclaimed some of the land. However, even if they reclaim all the acreage they are presently using, what about the 'pre-law' land? "Substitution" laws indicate some stability but certainly not progress!

This situation appears on the surface to be beyond hope, but it may be an opportunity for Corps of Engineers troops to receive some truly meaningful training of significant value not only to the Ecological State-of-the-Union', and to the U. S. Army, but to the Corps of Engineers in particular.

The training of heavy equipment operators requires a great deal of experience if the operator is to become capable of successfully accomplishing his required tasks in combat. Current Military Occupational Skills (MOS) training teaches the individual soldier the basic required skills, but experience is still lacking and necessary if the operator is to meet required Corps of Engineers standards. This 'experience' frequently referred to



as "stick-time" must come from our unit training.

Unit training seldom provides the number and magnitude of worthwhile earthmoving projects due to restrictions limiting the use of military construction units in CONUS. The next logical question that arises is: Can the Corps of Engineers use engineer troop units for land reclamation projects, allowing the projects to serve as teaching vehicles? This question stimulates a series of questions, some of which are: Does the Corps of Engineers want to get involved in land reclamation? Can selected land reclamation projects provide an adequate teaching vehicle? Which policies, laws, and regulations need be investigated? What are the cost considerations? What coordination problems would be created? What are the techniques being used by industry in this field? Certainly there are many advantages and disadvantages and each of them would require a detailed investigation, but let us speculate on some of the advantages and identify one technique in land reclamation.

From the cost aspect it may be worthy to note who is paying for land reclamation.

A more popular approach currently being considered by some companies is that reclamation costs be borne as a portion of their public relations and advertising costs.

A second interesting item is that on April 10th, 1972 the state of Ohio passed a severance tax on coal. The tax charges four cents per ton, and the monies are to be applied toward the reclamation of 'pre-law' surface mined land.

Clearly the most significant expenses for land reclamation are the wages of the equipment operators and the costs of the necessary equipment. On the other hand the MOS trained operator/soldiers will be paid whether they are operating their equipment or not.

Would the state and federal governments agree to use federal troops with funding assistance from appropriate state taxes for land reclamation?

One technique used for land reclamation could influence the cost and possibly provide another ecological benefit. This method makes use of fly ash, an industrial waste, to neutralize acidic surface mined areas.

Experiments in reclaiming acidic surface-mined coal lands with raw fly ash were conducted over a three-year period by the Bureau of Mines at two sites in Northern West Virginia. Plots at both sites were treated with varying tonnages of fly ash from three area power plants and were planted with a variety of grasses, legumes, trees and shrubs. The greatest promise for growth under harsh soil conditions were shown by Kentucky 31 fescue, rye and red top grasses and bird's foot trefoil, a legume. The fly ash was alkaline by nature and as a result tended to neutralize the acidic soil which was treated. The fly ash also improved the texture of the soil and improved

the available water of the resulting mixture.

The experiments demonstrated the feasibility of disposing of large quantities of the fly ash on surface mine spoil to reclaim these areas. Gross yields on this reclaimed land equalled or exceeded the average values for the state of West Virginia.

The use of the land after reclamation would indicate the agencies that need be involved during the planning phases. Some of the concerned agencies might be the local chapters of the: Chamber of Commerce, Fish and Game and/or Wildlife Commission, Forestry Service, Future Farmers of America, Boy Scouts, and Community Governments. By the nature of their involvement, these agencies could influence the impact of this type of undertaking on society, and perhaps allow the Army, specifically the Corps of Engineers, to reflect the favorable image that has been so elusive in this decade. Additionally the Corps of Engineers might be able to influence communities to use appropriate sites as sanitary land fills, if the Corps were granted final site selection approval authority.

Projects of this nature would show the Corps of Engineers "active" in conserving our environment and fulfilling the necessary development of combat ready forces in a peace time situation. Training in this mode could be a vehicle to fulfill even other goals as this endorser suggests.

If our volunteer Army Concept is to be a success we must initiate programs that will make service life more attractive and serve to enhance the Armies image. This program is among other things, an attempt to diffuse the anti-military feeling that seems to have permeated our society. This anti-military feeling has served to reduce reenlistments, morale, and overall, military proficiency. One major problem that everyone is concerned with is the environment. This program certainly can be considered an environmental endeavor and as such would give a great deal of meaning to the young men working on these projects. The realistic training value would be tremendous, and reenlistments might certainly skyrocket, at least in the concerned units.

This is the type of training that should be welcomed with enthusiasm. In the words of L. Edwin Coate, P.E., White House Fellow, Executive Office of the President, Council on Environmental Quality, "If Engineers are to stay relevant we must get involved."

Captain Leonard J. Jagoda, who only recently completed the Engineer Officer Advanced Course, USAES, Fort Belvoir, Virginia, is a former instructor in demolitions at the Infantry School, Fort Benning, Georgia. He served in Vietnam with the 34th Engineers (Construction) and the 26th Engineers, 23rd Infantry Division (AMERICAL). The captain is a 1968 graduate of the Engineer Officer Candidate School program at Fort Belvoir.

AN ENGINEER IN THE BLACK HILLS

Eugene V. McAndrews

Captain William Ludlow, chief engineer officer for the Department of the Dakotas from 1872-1876, was skeptical about what others labeled "Custer's Luck." Ludlow, the second son of General William Ludlow's six children, was an 1864 West Point graduate who in only one year of fighting with Sherman in the South attained the rank of brevet lieutenant-colonel. His frontier assignment was the result of Generals Alfred Terry's and Custer's request for trained Army engineers to assist in defeating the Plains Indians. Engineers were needed to build forts, determine exact map positions, and overcome engineering feats posed by the rugged frontier.

Ludlow served as chief engineer on Custer's famous Black Hills Expedition, recording his own views on the landscape, the Indians, and Indian policy. He also later explored and charted parts of Yellowstone National Park, urging that it be protected from frontier folk who ravaged its natural wonders. In 1874, he suggested that forts in Indian country would deter the hostiles. These forts did not become important until after Custer's defeat at the Little Big Horn in June 1876.

Later in his career, Ludlow served as Military Attache in London, as Chairman of the 1895 Nicaragua Canal Board, and as Chief Engineer for the District of Columbia. He earned a brevet star and line command during the Spanish American War and became Military Governor of Havana. On January 21, 1900, he received a brigadier general's commission in the Regular Army. After formulating plans for creation of a General Staff, he left for the Philippine Islands following the start of the insurrection against U. S. rule and while there became seriously ill. He died on August 30, 1901.

His journal of Custer's 1874 Black Hills Expedition provides living descriptions of the Plains environment and its changing moods. It presents many of the frontier's dangers and portrays Ludlow as a pensive man not given to rash judgments. Ludlow felt the U. S. was needlessly pushing the Indians into a war. He felt that miners had not discovered quantities of gold in the Black Hills as they claimed — causing the fortune-seekers' stampede into lands the U. S. had granted the Sioux by treaty. The journal presents, in essence, an engineer's view of the frontier, U. S. frontier policy and its ramifications, and military engineering. The Editor.



Brigadier General William Ludlow

Ludlow's Journal follows —

Orders: "Captain William Ludlow, chief engineer of the department, will report to Lieutenant-Colonel Custer as Engineer Officer of the expedition. He will be accompanied by his civil assistant and three enlisted men of the Engineer Battalion."

July 2 — The immense reservation secured to the various bands of Sioux, now the most numerous and warlike of the northern tribes, by treaty of April 29, 1868, lies between the one hundredth and fourth meridian of longitude and the Missouri River.

This immense tract, inclosing nearly 43,000 square miles, the greater portion of which, however, is bare and often arid prairie, destitute of every attraction for the settler, and only capable of supporting a scanty population of hunters, has for its choicest and most valuable portion the Black Hills, which lie on its western border. All reports agreed as describing this as a mountainous, heavily-timbered tract, abounding in game, and containing within its unexplored interior an open, fertile, and well-watered region.

In case, at any future time, complications with the Sioux or the advancing needs of bordering civilization should make it necessary to establish military posts upon this Indian reservation, indications all pointed to the Black Hills as the suitable point . . .

It was therefore considered desirable to gain positive information . . .

Our personnel consisted of 10 companies of the Cavalry, one each of the 20th and 17th Infantry, a detachment of Indian scouts, together with the necessary guides, interpreters and teamsters. There was a total of about 1,000 men. The wagon train consisted of about 110 wagons and ambulances and the artillery had but three Gatlings and a 3-inch rifle.

For surveying purposes my detachment of six engineer soldiers was employed. The two sergeants, John Becker and George Wilson, each with one man as an assistant, kept separate trails, with prismatic compass and odometer — one with an odometer-cart, a two-wheeled vehicle specially constructed for the purpose; the other in an ambulance. Two odometers were read on each vehicle, and the compass-notes were kept as full as possible. Two chronometers were carried by the fifth man in a basket while a record of thermometer and aneroid barometer readings were kept by the sixth man during the day.

The additional instruments were a small Wurdemann transit, No. 94, and a Spencer, Browning & Co. sextant, No. 6536. The general topography during the day was taken as thoroughly as possible . . . and night observations were made whenever practical. The positions of all but 10 of the camps were astronomically determined.

The direct course to Bear Butte, a well-known point north of the Black Hills, is south $39\frac{1}{2}^{\circ}$ west. The air-line distance is 202 miles. As it was known the intervening country was dry and woodless, General Custer considered that his people would find a better road by inclining westward toward the divide east of the Little Missouri and then turning south, than by pursuing the straight course. Prairie travel resembles travel by sea, which indeed the landscape not unfrequently suggests. With the compass as the guide, the direct course is not always the best, and the probabilities of finding wood, water, and grass, and a good road, compare with those of obtaining favorable and moderate winds and smooth sea.

The Dakota prairies have often described, but their general characteristics may be briefly stated. It is a rolling and at times a hilly country, destitute of wood, except small quantities in the eroded valleys of streams covered with short grass. The horizon is bounded everywhere by some more dominating elevations which constitute the landmarks for the traveler and are called buttes.

The summer sun shines from a generally cloudy sky and the purity of the air gives its rays great power. And the thermometer frequently rises above 100° in the shade. Water is scarce, and

almost infrequently alkaline, even in running streams, from the presence of a salt which forms a component of the clay-like soil. The rivers are small streams of great comparative length, which, from absorption and evaporation, shrink in their downward course, and are frequently dry at their mouth while flowing freely a 100 or so miles above.

The whole country was once ranged over by enormous herds of buffalo, whose trails are everywhere visible, but which are now seldom or never found east of the Little Missouri. The only game animals inhabiting the vast waste are antelopes, numbers of which have been seen during every day's march. The grasshopper, having proved himself to be one of the most serious obstacles to the future successful colonization of the country, is worth brief mention.

Previous to the departure of the expedition . . . the grasshoppers were very numerous. I counted 25 one morning on what I judged to be an average square foot of ground. A brief calculation at that rate would add out to over a million to the acre. As they are often much more numerous than then observed, and are exceedingly rapacious, their capacity for destruction to living vegetation may be imagined.

In descending through the slanting rays of the sun, grasshoppers resemble a fall of huge snowflakes. In one of our camps there must have been a hundred to the square foot. They were crowded as thickly as they could stand upon the ground, and every blade of grass bore several.

July 3 — The course pursued by General Custer was successfully pursued.

July 10 — The . . . march was still west, and a little north, up the valley, in which we were camped. The grasshoppers were in immense numbers during these two days.

July 17 — During the night heavy clouds and lightning appeared, and, toward morning, a severe wind-storm routed us from sleep and covered us with sand.

July 19 — The command remained in camp. The distance marched from Lincoln was 292 miles, an average of 18 and a quarter miles per day. Heavy rain fell until 4 p.m., and the huge camp-fires were a luxury all day.

July 20 — The first day's journey was made into the hills. The temperature was delightful; the air laden with sweet wild odors; the grass knee-deep and exceedingly luxuriant and fresh; while wild cherries, blueberries, and gooseberries abounded, as well as many varieties of flowers.

July 22 — The course led southward up the Redwater valley [sic], which is from four to 10 miles in width, bounded by high hills heavily timbered with pine. The gypsum appeared in enormous quantities. One of the guides took me

off to the right to see a huge mass of it, crystalized and shining beautifully in the sun. The Indians, for generations, have, in passing, split off pieces for ornaments, and by degrees cut a shoulder several feet deep on it at the level of the ground . . . A heavy and well-marked pony and lodge trail led up the Redwater valley southeasterly to the Red Cloud and Spotted Tail agencies.

July 23 — The command remained in camp while a party started out to make the ascent of Inyan Kara, about five miles distant. It resembles a lunar mountain, having a rim in shape of a horseshoe, one and a half miles across, with an elevated peak rising sharply from the center. The rim, 1,142 feet in height above the exterior base, has a sharp edge at the summit, and falls steeply on both sides.

July 26 — Still ascending Floral valley, the divide was reached, and we almost insensibly passed into the hills of another stream, falling rapidly to the southeast. The hills became gradually higher and the valley wider. The beaver had made frequent dams, and their labors occasionally added to those of the pioneers in making a road for the wagons. In the afternoon we had our first encounter with Indians. A village of seven lodges, containing 27 souls was found in the valley. The men were away peacefully engaged in hunting; the squaws in camp drying meat, cooking, and other camp avocations. Red Cloud's daughter was the wife of the headman, whose name was "One Stab." General Custer wanted them to remain and introduce us to the hills. However, we had a party of Rees among our scouts who were constantly at war with the Sioux. This made the Sioux very uneasy, and toward nightfall they abandoned their camp and made their escape. Old "One Stab" was at headquarters when the flight was discovered and was retained as both a guide and hostage.

July 27 — The command remained in camp, to give time to examine the neighboring country. The gold-hunters were very busy all day with their shovels and pans exploring the streams. Several surveying-parties were sent out in various directions . . . The grass in places was as high as a horse's shoulder. This portion of the Black Hills evidently never suffers from drought. No arid places are seen except on the summits of the limestone ledges. Springs are numerous and very cold and pure. The soil is moist, and the vegetation is marvelously luxuriant and fresh . . . The warm currents of air from the plains condense as they ascend the slopes of the hills, and are robbed of their moisture in the fog, rain, and heavy dews that occur nightly. The clouds almost invariably formed in the afternoon and interfered greatly with astronomical observations.



Bloody Knife, General Custer, Captain William Ludlow, and standing is Trooper Private Noonan.

July 28 — The valley below us was almost too marshy for the wagons . . .

Harney's Park was visible from the top of a high, bare hill. The sun had just set and in a few minutes we were well rewarded for the five mile ride . . . A patch of bright blood-red flame was first seen, looking like a brilliant fire, and soon after that there was another so far from the first it was difficult to connect the two. A portion's of the moon's disk soon became visible and the origin of the flame was apparent. While it lasted the sight was superb. The moon's mass looked enormous and blood-red with only portions of its surface visible. On the other hand the clouds just above and to the left, colored by the flame, resembled smoke drifting from an immense conflagration. The moon soon buried herself completely in the clouds, and under a rapidly darkening sky we returned to camp.

July 31 — The command remained in camp, while survey parties were sent out and the gold-hunters redoubled their efforts. Escorted by a company of cavalry General Custer, myself, Professors Winchell and Conaldson and Mr. Wood, set out to ascend Harney . . . Leaving the horses at the foot of the clear granite, the ascent was made on foot. Halting to rest and lunch, we saw another summit, two or three miles west, rising higher than the one we were on. Reaching the summit of this one, still another, several hundred feet higher, and a mile more west, showed that we had more work to do. A stiff climb brought us to the top, whence nothing more lofty could be seen. Here we stood on the most elevated portion of the hills some 9,700 feet above the sea, except that alongside us rose a mass of granite 40 feet in height, with perpendicular sides that forbade an



attempt to scale them without the aid of ropes and ladders . . . The view was superb, extending over the intervening peaks and hills to a broad expanse of prairie from north by east round to southwest.

The course of the forks of the Cheyenne could be distinctly traced, and a dim line visible to the southeast was even thought to be the hills of White River, 50 or 60 miles distant. Bear Butte, 40-odd miles to the north, was again seen over the wooded ranges, and all but Inyan Kara of the principal peaks were in view. Two of the prominent ones I have names for General Terry and General Custer.

The return to camp was a struggle against almost every possible obstacle — rocks, creeks, marshes, willow and aspen thickets, pipe timber, dead and fallen trees, steep hillsides and precipitous ravines. With all the difficulties multiplied by the darkness and only the stars for a guide, we still reached camp at 1:30 a.m.

August 2 — Command is still in camp. There is much talk of gold and the industrious search everyone is making for it. In General Custer's tent I saw what the miner said he had obtained during the day. Under a strong reading-glass it resembled small pin-heads, and fine scales of irregular shape, perhaps thirty in number. The miners were quite confident that if they could reach bed-rock in the valleys at a favorable place, plenty could be obtained by use of the pan.

General Custer decided to take a scouting party

south to the South Fork of the Cheyenne, for the purpose of examining the intervening country and send another party eastward, following the creek where we were encamped to its junction with the same stream. These two explorations would cover considerable country and complete the examination of the south and southeast portion of the hills.

August 3 — The headquarters, with five companies of cavalry and a few pack-mules started on the reconnaissance. Lieutenant Richard Godfrey, with an escort of two companies, left at the same time to follow down the creek. The headquarters trail led south and southwest through park country, until it reached the head of a creek that flowed southwardly. This was pursued all day, leading us at first into a narrow valley, hemmed in by the wooded hills. The character of the country changed gradually as we went south. The valley grew broader, the hills lower, grass drier, and timber more and more scarce . . . Emerging from this into smoother country, we halted for the night a few miles from the South Fork after accomplishing a march of 45 miles. No instruments were taken on this trip, as the column moved without wagons and the sextant was needed in the permanent camp.

George Reynolds, a white scout, was dispatched late at night with the mail. He had about 75 miles in an airline to make it to Laramie alone, through country infested with Indians. He also had the additional disadvantage of crossing their probable routes at right angles where he could suddenly run across them. We were greatly relieved to learn afterward that his trip had been successfully made, though not without privation.

August 6 — Camp was broken for the return trip. General Custer decided that instead of going eastward on the prairie to partly retrace his steps and examine the practicality of trying a route northward through the hills which would bring us out somewhere near Bear Butte. This plan would complete the examination of them . . . A heavy thunder storm came up during the night and the echoes among the hills were exceedingly grand.

August 7 — The storm of the night before had swelled the brooks but the old trail furnished a good road . . . Two grizzly bears were killed near this camp and the first grasshoppers seen in the hills in any numbers were swarming in both creek valleys.

August 11 — While General Custer made exploration for a road eastwardly, I returned to the camp of the day before with a surveying-party to measure a base line and locate the important elevations with a transit . . . Returning to camp, I found that several elk had been killed during the day by the hunters.

August 13 — Lieutenant Godfrey was dispatched down the creek to determine its course and ascertain his position from bearings to Bear Butte and Harney after clearing the hills.

August 14 — The scorching sun and hot, dry breath of the prairie, covered with yellow grass, bore instant witness to the change in our former surroundings. The coolness of air and freshness of vegetation, the abundance of pure, cold water, the noble, camp-fires, and quantities of game that had made our stay in the hills a daily delight, compelled us to contrast it with the dry, dusty journeys, the warm alkaline water, and scanty wood which awaited us on the return march of over 3,800 miles.

August 16 — When crossing the Belle Fourche we found it to be a rapid stream, in a shaley and gravelly bed, 80 feet wide and a foot deep; the banks low, and cottonwood abundant. We met four Cheyenne Indians enroute to the agencies from the hostile camp on Tongue River who reported that Sitting Bull was preparing to intercept us at the Short Pine Hills with 5,000 warriors.

August 20 — Traveled north and west across several heads of Grand River, and over a rolling prairie, which had been burned by the Indians to harrass our march. We could find no camp on the prairie because it was black as far to the northward as the eye could see. This forced us to

make a rapid descent into the valley of the Little Missouri, where we found wood, water, and grass among the bad lands.

August 23 — The course was north and east, over a high rolling prairie, until we encountered the Yellowstone expedition trails . . .

August 30 — Fort Lincoln was reached at 4:30 p.m., of August 30, the 60th day of the trip. The wagon-train had traveled 883 miles, and, adding the various reconnaissances, we had surveyed a total of 1,205 miles.

No matter what may ultimately be determined as to how much precious metal is in the Black Hills from the evidence that was gathered on the trip I conclude there is little. The real wealth and value of the country is, beyond doubt, very great. Utterly dissimilar in character to the remaining portion of the territory in which it lies, its fertility and freshness, its variety of resource and delightful climate, the protection it affords both against the torrid heats and arctic storms of the neighboring prairies, will eventually make the Black Hills the home of a thronging population.

To this, however, the final solution of the Indian question is an indispensable preliminary. The region is cherished by the owners both as hunting-grounds and asylum. The more far-sighted have anticipated the time when hunting buffalo, which is now the main subsistence of the wild tribes, will no longer suffice. So they are looking forward to settling in and about the Black Hills as their future permanent home. There they will await the gradual extinction of their race which is their fate. For these reasons, no occupation of this region by whites will be tolerated . . . Hostile incursions would not be infrequent, nor an occasional massacre unlikely, and these are conditions unfavorable to a rapid and permanent increase of population. The Indians have no country farther west to which they can migrate . . .

Ludlow had great vision but the Indians have retained much of their land in the Black Hills. And although a century has passed since Ludlow made his observation, the American Indian is far from extinct as a race.

Eugene V. McAndrews, an authoritative source on the history of the Medal of Honor, was a historian, Office of the Chief of Engineers, US Army, Baltimore, Md. Mr. McAndrews considers his collection of historical material, diaries and memorabilia of US Army winners of the Medal of Honor among the most complete in existence. Credited with a B.A. in history from Carroll College, Helena, Mont., and an M.A. from the University of Oregon, Eugene, Ore., he is presently preparing a Ph.D. dissertation for Kansas State University, Manhattan, Kansas.



SWORDS INTO PLOWSHARES!

Captain James L. Keener

"The introduction of power machinery, such as steam shovels during railway construction in the last century and large earthmoving plants, such as D8 tractors and 12 cubic yard scoops in the late 1930's, brought about a change in scale. Excavations of some hundreds of feet in depth became relatively common. In effect, the scale of everyday construction was increased tenfold. The Plowshare devices at present available show up at scales ten times greater again."

Thus was the enhancement of man's ability to change the earth with nuclear explosives as described a decade ago. Two events, the development of a thermonuclear explosive device and the establishment of the Plowshare Program in Livermore, California in 1957, provided the genesis of a testing and evaluation program that has awakened scientists and engineers to the possibility of using nuclear explosives for peaceful purposes. As could be readily imagined, a major limitation on the employment of nuclear devices is their great power potential, not their lack of it.

Engineers today foresee the possibility of using nuclear devices in three general areas: mineral and gas exploitation, vast underground storage areas, and massive construction projects.

By far, the most productive work to date has been in the area of mineral and gas exploitation. It is well known that the United States will face a critical shortage of natural gas within this decade. Already in some areas industries and homebuilders are restricted in their installation of equipment or appliances requiring natural gas as a fuel. Tests have been conducted and are under way that could

provide the basis whereby the nation's useable natural gas reserves would be markedly increased. The use of underground nuclear detonations in areas previously too difficult to tap is now economically feasible. Of interest to the military engineer is the possibility of using thermonuclear devices to create quarries large enough to support massive construction projects.

Much investigative work and experimentation has been devoted to determine the feasibility of using nuclear explosives to construct transportation facilities by excavation. Applications of nuclear explosive excavations could range anywhere from a transisthmian canal in Central America to the construction of a deep water harbor on almost any coast. Nuclear devices also could be detonated deep underground to provide reservoirs for water storage or solid waste disposal.

The effects of blast, ground shock, and nuclear radiation limit the employment of nuclear devices in construction projects. The specific limits are fairly well defined, and the information concerning them is available in Atomic Energy Commission publications. The primary limitations to the use of nuclear explosive devices for peaceful purposes are political. The nuclear test ban treaty and local popular concern are two major restrictions. But with the energy crisis mounting each passing day it would seem likely that these restrictions will be lifted.

It is likely that underground nuclear explosions will be used to release natural gas deposits in this decade. Use of nuclear explosives for surface engineering is possible and economically feasible.

Science and engineering have given us the capability of turning our nuclear swords into plowshares.

Captain James L. Keener is a graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia.



CESPR: FIRST EVER

CPT Walter J. Wells
CPT James L. Campbell

The Combat Engineer System Program Review (CESPR) was conducted at Fort Belvoir, Virginia last April. Each year a series of System Program Reviews are conducted for the Vice Chief of Staff of the Army. These reviews cover specific areas of interest such as aviation, infantry, signal, or artillery.

The purpose of the System Program Reviews is to provide the Vice Chief of Staff and other senior Department of the Army officials an overview of a particular Army system. These reviews are not intended to be decision briefings; rather they provide a forum where attendees can contribute their ideas and air their views on the system under consideration.

The 1973 CESPR was the first review of the combat engineer system. The one-day event was

attended by over 40 general officers and key civilian officials. Engineer general officers from the DA Staff and major commands were among those attending the review. The full day of activity at Fort Belvoir included eight formal presentations and two demonstrations.

Lieutenant General Fred E. Clarke then Chief of Engineers, welcomed the participants to CESPR and stated that the objective was to "stimulate discussion and receive guidance on those engineer actions required to increase the mobility, survivability, effectiveness, and combat power of the Army."

General Clarke indicated that a major concern on the engineers is that "we may not be keeping up with the rest of the Army, particularly in mobility." He pointed out that while strategic



mobility has increased by a factor of 50 and battlefield mobility by a factor of 20, the engineers' capability to enhance mobility has not increased accordingly. He noted that significant advances in tactical bridging have been made with the development of the ribbon bridge and medium-girder bridge, but that countermine warfare capability has not increased significantly.

The thread of resources tied CESPR together. A viewgraph showed the engineer slice of the PEMA (Procurement of Equipment and Missiles, Army) pie to have averaged about five percent over the last decade — not a lot of money for a branch that contributed significantly to improving and maintaining the Army's fighting power and has historically made up over 10 percent of the Army.

Army-wide information and expertise was sought and utilized at CESPR. The directorate of Military Engineering and Topography of the Office of the Chief of Engineers had primary responsibility for the planning and coordination of the many diverse efforts that went into CESPR presentations. The briefers were drawn from outside of OCE as well as from within. Outside agencies included the Assistant Chief of Staff for Intelligence (ACSI), the former Combat Developments Command, now part of TRADOC and the Engineer School, the Deputy Chief of Staff for Personnel (DCSPER), as well as the Army Materiel Command.

The two demonstrations that were conducted during CESPR included a morning demonstration using a combat engineer company with additional supporting equipment from the battalion headquarters, the light equipment and bridge companies assembled in a "U" formation. The demonstration vividly emphasized several points that could not have been so uniquely made in formal briefings. The afternoon equipment display was a roll-by of a construction engineer company and its augmenting equipment from the battalion headquarters.

The acute need to develop and implement an integrated countermine capability doctrine was noted and it was emphasized that doctrine for command and control of scatterable mines remains to be developed. It also was noted that the key to improved camouflage discipline is command interest and individual training. It has been stated that further examination of repair parts support for low-density equipment is warranted.

Experts agreed with a key point made in the base development presentation that more realistic construction standards must be established for the Base Development Plans presently being prepared. The excellent results of the Commercial Constuction Equipment (CCE) program were

noted and the continued infusion of this was endorsed as the way to go. Finally, the need to place engineer representation on several of the key Army programing and planning groups such as the Material Procurement Priorities Review Committee (MPPRC) and the Research and Development Board was emphasized.

The first CESPR proved a valuable experience for the Army Engineers. CESPR required considerable preparation and hence compelled the engineer community to come together to define objectives and priorities. CESPR has successfully put engineer concerns and problems before the most important men in the Army, resulting in a better appreciation of engineer problems by Army leaders at the highest levels. Seeds were planted at CESPR and the fruits of the trees to grow will continue to be harvested for many years hence in the form of improved engineer understanding and decision at higher levels. The continuation of Engineer System Reviews is essential to insure exposure of high-level officials to engineer problems as they develop. It is anticipated that the next CESPR will be conducted in April 1975.

Captain Walter J. Wells is presently assigned as a senior analyst in the Engineer Strategic Studies Group (ESSG). While at ESSG he has worked on a number of significant studies which dealt with the organization and equipment for major engineer units in the near future. Prior assignments include command in Korea, Fort Belvoir and Vietnam as well as experience in the Sacramento Engineer District. Captain Wells graduated from West Point in 1965 and served two years in the armor branch before transferring to the Engineers. He is a graduate of EOAC and obtained a Masters degree in Civil Engineering Management from Purdue University in January 1972.

Captain James L. Campbell is currently with the Engineer Strategic Studies Group, Office of the Chief of Engineers. Prior to this assignment, Captain Campbell served with the Lines of Communication Division of the US Army Engineer Command, Vietnam. A previous tour of duty in RVN as a company commander with the 589th Engineer Battalion (Construction) provided him with first hand construction experience. Other highlights of his military career include assignments as a platoon leader and company commander with the 54th Engineer Battalion (Combat) in Germany. He received a B.S. degree from the South Dakota School of Mines and a Masters degree from Texas A & M University. He is also a graduate of the Engineer Officer Advanced Course.

WHEN THE COLD WIND DOETH BLOW!



Captain Thomas J. Quigley

As long as Alaska remains an integral part of the United States of America possessing natural resources and strategic importance, elements of the U.S. Army and the Corps of Engineers will be in direct contact with the debilitating temperatures of the subarctic cold.

Winter lasts for about eight months in Alaska. During that time, one might experience 166 inches of accumulated snowfall; 156 consecutive days below 32 degrees fahrenheit; temperatures dropping 40 degrees in one hour after a day of two hours sunlight. Longtime residents of these extremes point out that the harsh weather is nothing to fear. However, it is never to be disrespected. With these thoughts in mind, consider the abysmal difference between operating equipment in Alaska as opposed to Fort Belvoir, Birginia. The challenge is peculiar and distinct.

Colder weather brings increasing impact on the importance of maintenance at all levels, particularly operator maintenance. It is no revelation that water freezes at temperatures below 32 degrees fahrenheit. Fluctuating temperatures cause noticeably poorer performance in vehicles due to the condensed moisture in fuel lines which subsequently freezes. Failure to drain the fuel filters or fill fuel tanks each night invariably results in inoperable equipment. Antifreeze must be added to the fuel as well as the cooling system. Condensation occurs readily in the engine compartment where temperatures normally reach 200

degrees. The night temperatures often exceed —60 degrees, cooling each vehicle as much as 260 degrees.

Motor vehicles equipped with winterization kits have a gasoline fired heater in the cab. These heaters can direct heat to the engine or the passenger compartment. Prior to starting the engine in the cold the crankcase oil must be heated since its viscosity decreases decidedly in cold weather. The battery's efficiency is also halved. These two factors coupled with the refusal of the fuel to atomize and combust makes starting an engine difficult. Noncumbusted fuel accumulation can result in hydrostatic lock in diesel engines or dilution of the crankcase oil in gasoline engines. Hydrostatic lock occurs when too much fuel is retained in the cylinder which prevents the piston from traveling to top dead center, possibly breaking the piston or the head. Similarly, in gasoline engines, uncombusted fuel may wash down the cylinder walls and dilute the crankcase oil which reduces proper lubrication when the engine is subsequently started.

Away from the engine, other problems may arise. Wise use of the gas personnel heater must be stressed. Naturally any fuel combusting process produces carbon monoxide. Ventilation is a must. Defrosters cannot be directed on the windshield until it is heated by the ambient temperature of the cab, or the glass will crack due to the rapid change in temperature.

Refueling can present problems to the careless.



A five gallon can of fuel is a definite threat of frostbite to the unaware. This threat was best illustrated to newcomers in the form of a short story of three soldiers who were having a great time administering themselves doses of "anti-freeze" until their supply dwindled. One remembered his bottle under the seat of his car outside. He dashed out in the sub-zero temperatures, retrieved the stock and rushed back inside. To the praise of all he uncapped the bottle, took a great swallow, and was abruptly reminded that alcohol does not freeze at -40 degrees, unlike the interior of his mouth. Booze, like fuel, remains liquid at all naturally occurring cold temperatures and can freeze human skin on contact.

While operating in the field in the absence of warm storage facilities the cold and accompanying chill factor tends to "coldsoak" vehicles in approximately three hours, rendering them impossible to start. The only remedy to this lies in a procedure of starting each vehicle on a two hour interval, allowing them to warm up, then shutting them off after 20 minutes. This procedure is a 24 hour task that must be observed to maintain ready vehicles.

Another bothersome phenomenon resulting from frigid temperatures is ice fog, formed at minus 29 degrees by frozen particles of moisture suspended in the air. It is similar to ordinary fog and decreases visibility proportionally. Moisture is

readily produced as a by-product of combustion in engines and therefore can be expected to remain in the area of operations and present a hazard to movement. In tactical situations it acts as a dead giveaway of concealed positions. The wind rarely blows in the interior of Alaska during cold snaps making ice fog a problem. Thus, the speed of motor movements must be reduced.

Engineer equipment such as bulldozers must be especially cared for during nonuse in the field. A living example presented itself when, after the day's clearing operation ceased, the dozer was parked near the bivouac in the muskeg. Next morning a herman-nelson heater was directed on the engine to preheat the D-8. After the engine was started and allowed to warm, the operator engaged the clutch and first gear only to have the engine nearly stall while the dozer remained immobile. During the night the dozer had frozen to the ground! An enterprising squad leader insisted the operator put the transmission and transfer in the lowest combination, raise the idle and pop the clutch. Naturally the weakest link of the chain gave, in this case, the transmission. Similarly reverse gear also failed.

The result of the underestimation of mother nature's forces was an immobile dozer stuck to the ground. The situation was eventually solved by erecting a GP medium tent over the dozer, heated and supervised by our favorite squad leader. From that location the D-8 was eventually hauled away to depot maintenance. The waste in time, equipment and money could have been prevented by merely parking the dozer on logs or other non-frost susceptible material.

Armed with the knowledge of these few perils of cold weather operations and a healthy respect for the forces nature has at its disposal, a unit commander or maintenance officer will be able to gauge the capability of his unit and the possible problem areas cold weather may present. Emphasized above all is the fact that the soldier must endure the extreme elements as well as his equipment. Advance planning and thorough forethought will pave the way for successful completion of the mission.

Captain Thomas J. Quigley is a graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia. He also is an ROTC graduate of Eastern Washington State College and has served a tour in Korea with the 36th Engineer Group (Combat) and was Detachment Commander of the 109th Engineer Battalion (Combat ROKA). Later the Captain served as Maintenance Officer, S-4 Officer, and Commanding Officer of Company A, 808th Engineer Battalion (Construction) Fort Wainwright, Alaska.

BRIDGING

SENIOR NCOs SUPERVISE 80 PERCENT OF ARMY PERSONNEL RESOURCES

THE REQUIREMENT FOR NCOES stems directly from the basic needs of the U. S. Army for more effective leadership, at all levels. The senior noncommissioned officer supervises or controls approximately 80 percent of the Army personnel resources. He is, therefore, the key man in the military management structure. The success of the NCO depends on his technical knowledge as well as his ability to effectively direct people toward an assigned objective. The senior NCO has been fulfilling his role as "backbone of the Army." Over the years, he has been the doer, and the price exacted has been in terms of his progressive professional development. Today's Modern Volunteer Army cannot deny the importance of tradition in the military service but neither can today's leaders dispute the need for enlightened leadership, personalized to the individual and the situation, balanced by professionalism and confidence.

EOAC OFFERS STUDENTS ELECTIVES FOR PROFESSIONAL DEVELOPMENT

IT HAS LONG BEEN RECOGNIZED that the varied needs and interests of individuals enrolled in each of the professional development courses at the US Army Engineer School cannot be accommodated by an inflexible core curriculum. One partial solution to this problem is the continual modification of a program of instruction to reflect both the generalized changed requirements of a changing student population and the revised job requirements of course graduates. Another solution is the partial individualization of a program of instruction by providing a heterogeneous group of students with a series of elective options; the student is afforded an opportunity to complement a core curriculum with courses or programs which suit his desires.

LEONARD WOOD'S 4TH AIT BRIGADE LAUNCHES TWO NEW COURSES AND CHANGES TWO OLD ONES

THE 4TH ADVANCED INDIVIDUAL TRAINING (AIT) Brigade at Ft. Leonard Wood, Missouri which has long been the major source of highly trained construction engineers has started two new courses and changed two of its old ones. The two courses added are the Plumbers Course, 51K20, and Electricians Course, 51R20. In the past the Army has had to rely on civilian school or on-the-job trained plumbers and electricians. These two new Courses should eliminate the Army's shortage of trained personnel in these MOSs. One of the courses being changed is the CSOC (Crane Shovel Operators Course). The Crane Shovel Operators Course has been split to allow training in two MOSs, 62F20 and 62F30. The 62F20 course trains personnel in handling material using a hook block. These personnel are designated Crane Operators. The other course will orient personnel in handling materials but will train them in the use of construction attachments for the crane. Graduates will be designated 62F30, Crane Shovel Operators. Both MOSs will allow progression through grade of E-5 without change in MOS skill level designation. The other course that is being changed is the Engineer Equipment Maintenance Apprentice Course. The change affects the kind of courses being taught. Instead of being taught the maintenance of each piece of equipment, they are being taught maintenance of engines, power trains, brakes, etcetera as a system. A crawler tractor may be different from a scooploader but the principles will remain the same. All indications are that the new approach will provide a better trained engineer mechanic to the field.

THE GAP

MANY EM ARE ELIGIBLE TO ATTEND ENCOES

MEMBERS OF THE ACTIVE ARMY or of a Reserve Component in the grade of E4 with less than eight years service or E5 with less than 12 years service who have demonstrated leadership potential for noncommissioned officer positions are eligible to attend the ENCOES Basic Course provided they are qualified in one of the listed prerequisite MOS's, have an MOS test score of 100 or more, and 13 months or more of active duty service remaining upon completion of the course. No security clearance is required. There is a one time eligibility as E3 at completion of Advanced Individual Training (AIT). Individuals who are selected for MOS training in an MOS that is a prerequisite for this course and who demonstrate exceptional leadership abilities during Basic Combat Training (BCT) and AIT may be selected to attend ENCOB immediately after AIT. These are the prerequisite MOS for ENCOB: 12A10, 12B20, 12B30, 12C20, 12C30, 12D20, 12E20, 12F20, 51A10, 51B20, 51C20, 51C30, 51D20, 51F20, 51G20, 51J20, 51J30, 51L20, 51M20, 51N20, 51R20, 52A10, 81A10, 81B20, 82A10, 82B20, 62D20, 62E20, 62F20, 62F30, 62G20, 62G30, 62H20, 62J20, 62J30, 62K20, 62L20, 62M20, 64B20, 81C20, 51Q20, 81D20, 81D30, 41B20, 41B30, 82A10, 82D20, 82D30, 82E20, 82E30, 83A10, 83D20, 83E20, 83F20, 41K20, 52B20, 52B30, 52C20, 52D20, 62B10, 62B20, 62B30, 62C20, and 62C30.

EPD ESTABLISHES CAREER ORIENTED MANAGEMENT SYSTEM FOR EM

THE ENLISTED PERSONNEL DIRECTORATE is in the process of establishing a career oriented management system similar to the system that is used by the Officer Personnel Directorate. Within this new career management organization — Management of Enlisted Careerist Centrally Administered — assignments will be made in accordance with specific career management guidelines and objectives for each military occupational specialty. As an integral part of this program three levels of military education have been established under the Non-Commissioned Officer Education System — Basic, Advanced, and Senior. The NCOES Advanced and Senior Courses will be viewed with equal importance for enlisted personnel as the Command and General Staff College and War College courses, respectively, are viewed for officers.

LOSING COMMAND MUST FURNISH EACH OFFICER LOCALLY REPRODUCED COPY OF HIS OER

ONE NEW AND SIGNIFICANT provision of the new Officer Evaluation Report (OER) system is that each officer will receive a locally reproduced copy of his completed OER (DA Form 67-7). In some cases, however, the OER is not completed until after he departs to a new assignment. It is the responsibility of the losing command to forward a copy of the OER to his new address. This system is not perfect because the report can get lost after it is forwarded. Individuals should query their old command after a reasonable time has elapsed to determine if a copy was, in fact, forwarded. If the report was forwarded but "lost" in the mail, the unit personnel officer should be able to furnish another copy. He is required to keep a copy for 120 days after the cutoff date of the reporting period. To minimize the chance of not receiving his copy of the OER, each individual should make sure he provides his personnel officer an accurate forwarding address prior to departing the command. Also, it should be noted that under the new OER system, appeal action must be initiated prior to the second anniversary of that report.

ENGINEERS
ARE



HAPPY
BIRTHDAY! 1775-1974



THE ENGINEER



SUMMER 1974

THE ENGINEER

VOLUME 4

NUMBER 2

SUMMER 1974

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CHIEF'S BRIEFS

Charles Gratiot, the U. S. Army's tenth Chief Engineer, was born in St. Louis, Missouri, on August 29, 1787.

Gratiot was appointed to the United States Military Academy at West Point from the Missouri Territory in 1804 by President Thomas Jefferson. He graduated from the Point in 1806 and was commissioned a second lieutenant in the Corps of Engineers.

Lieutenant Gratiot was promoted to the grade of captain in 1808 and was assigned to help (then) Lieutenant Colonel Alexander Macomb construct fortifications at Charleston, South Carolina. Later, from 1810 to 1811, Gratiot was the post commander at West Point.

During the War of 1812, Gratiot distinguished himself as General William Henry Harrison's chief engineer. Later, in 1819, he was appointed chief engineer of the Northwest Territory. Then, from 1819 to 1828, Gratiot was the superintending engineer for construction of defenses at Hampton Roads, Virginia.

Gratiot was promoted to colonel, breveted a brigadier general, and appointed as the Army's Chief Engineer on May 24, 1828.

The general was a brave and distinguished engineer for 32 years but his over-zealous attitude regarding interpretation of the law in rendering his accounts caused President Martin Van Buren to dismiss Gratiot from the Army in 1838. Army General-in-Chief Macomb and fellow officers sympathized with Gratiot and felt the President's action was too harsh.

Gratiot became a clerk in a land office and died in St. Louis on May 13, 1855.

**United States Army
Engineer School
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The Engineer is an authorized quarterly publication of the U.S. Army Engineer School. It is published to provide factual and in-depth information of interest to all Engineer units. Articles, photographs and art work of general interest may be submitted for consideration to: Editor, The Engineer, USA Engineer School, Fort Belvoir, Virginia 22060. Views and opinions expressed herein are not necessarily those of the Department of the Army. Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, January 1, 1974.

Subscriptions to THE ENGINEER are available through The Engineer School, Book Store, Fort Belvoir, Virginia. Annual rates are \$6.00 for mailing to a domestic or APO address and \$6.75 for mailing to a foreign address. Individual copies of the magazine are \$1.50 each. Checks should be made payable to the Fort Belvoir Book Store.

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ABOUT THE COVER

The diverse training activities associated with the "One Army" concept are graphically depicted in the photo montage featured on the cover of this issue. This training encompasses the combined efforts of the Active and Reserve forces and the National Guard. Several articles featured in this issue support the training objectives highlighted in "Readiness Is Spelled Training" beginning on page 18.

PIPELINE. PIPE

TWO DMA OFFICERS NAMED TO DISTRICT ENGINEER POSTS

Two Defense Mapping Agency officers have been named District Engineers by an Army Command Selection Board, according to Lieutenant General Howard W. Penny, Director of the Defense Mapping Agency (DMA) Washington, D.C.

Colonel Bernard C. Hughes, Chief of Plans Division, Headquarters DMA and Colonel George B. Gray, Deputy Director for Plans, Requirements and Technology, DMA Topographic Center were two of 11 officers selected for these key U.S. Army Engineer positions.

Colonel Hughes is the new District Engineer, Buffalo, New York, while Colonel Gray has been assigned as the District Engineer for Saudia Arabia.

There are 13 Divisions and 39 District offices, commanded by Engineer officers and staffed primarily by civilian employees. The work is decentralized so that each District Engineer exercises complete control for the Corps in his area.

The District Engineer is the Corps' action officer for regional and local water resource programs as OCE plans and executes a major national water resources development program under national policies and directives established by the President and the Congress.

In his area, the District Engineer heads the world's largest and most versatile construction agency. He directs waterways planning, design, construction and operation. In

most districts he provides a complete construction management and engineering service for the Army. He also designs and constructs for other U.S. Governmental agencies and foreign governments, when directed.

TESTS OF FIBROUS CONCRETE NEAR COMPLETION AT WES

Researchers at the Waterways Experiment Station in Vicksburg, Mississippi, are in the final stages of testing a concrete containing steel fibers.

Historically, high-tensile materials have been used to improve the strength of brittle, low-tensile materials. Straw has been used in sunbaked bricks, horse hair has been used to reinforce plaster, and more recently various types of fibers such as asbestos, nylon, fiberglass and steel have been used to improve the tensile properties of portland cement.

Concrete mixed with steel fibers, which has been used in funeral vaults for a long time, first caught the attention of the Corps of Engineers in the mid-60's because of its blast-resistant qualities. At WES the main interest in fibrous concrete is its possible use in building aircraft runways. The Federal Aviation Administration is supporting WES in this project.

In two series of tests (January 1971-March 1972, March 1972-May 1973) WES engineers subjected a total of four pavements to simulated loading

conditions of the C-5A and 747 aircraft. The test results showed that outstanding performance can be obtained from relatively thin pavements made from a mixture of concrete and randomly dispersed steel fibers.

The fibers WES used are commercially available in different sizes. Length varies from $\frac{3}{4}$ to $2\frac{1}{2}$ inches, and the diameter from 14 to 25 mils. The larger the aspect ratio of the fibers (length/equivalent diameter), the smaller is the required fiber content to produce a given strength. At WES the typical mixture of fibrous concrete contains 1 inch fibers and the fiber content varies from 100 to 300 lbs. per cubic yard.

WES also built a road with fibrous concrete to study its properties in regard to the need for joints in pavements. The road built was 1000 feet long, 24 feet wide, 4 inches thick, and contained no joints.

Upon curing, seven cracks appeared in the pavement, dividing the 1000-foot-long section into 8 slabs ranging in length from 60 to 240 feet. Crack widths varied from 0.2 to 0.5 inches. It is felt that with proper joint construction a uniform slab length of at least 100 feet could have been maintained. This is significant when one considers that usual slab lengths are from 10 to 25 feet.

This study, along with additional testing, will develop the technology for utilizing fibrous concrete as a paving material which will hopefully result in thinner, more durable pavements requiring less maintenance.

LINE. PIPELINE.

nance and providing improved performance over conventional paving materials.

HENK ASSUMES COMMAND OF 138TH GROUP AT FORT RILEY



of the Army, and Research and Development Coordinator for the Defense Atomic Support Agency. He also has served with the Alaska District Engineer's Office and the Japan Construction Agency.

A native of San Marcos, Texas, the Colonel earned a Bachelor of Science Degree from Texas A&M University and a Master's Degree from the University of Illinois. He also is a graduate of the Command and General Staff College, Fort Leavenworth, Kansas.

Colonel Henk is a registered professional engineer in Texas and is a member of the American Society of Civil Engineers and the Society of American Military Engineers.

INDUSTRY GETS LOOK AT FUTURE TROOP SUPPORT PLANS

"Troop Support for the Future" was the theme of an Advanced Planning Briefing for Industry (APSI) held recently in Humphreys Hall, Fort Belvoir, Va. The APBI was sponsored by the U.S. Army Troop Support Command (TROSCOM), St. Louis with the Command's Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, serving as host.

Conference organizers said some 400 participants from industry and government attended the briefing. The program included briefings on current projects and future plans by the chief of MERDC's five R&D departments and directors of TROSCOM's Na-

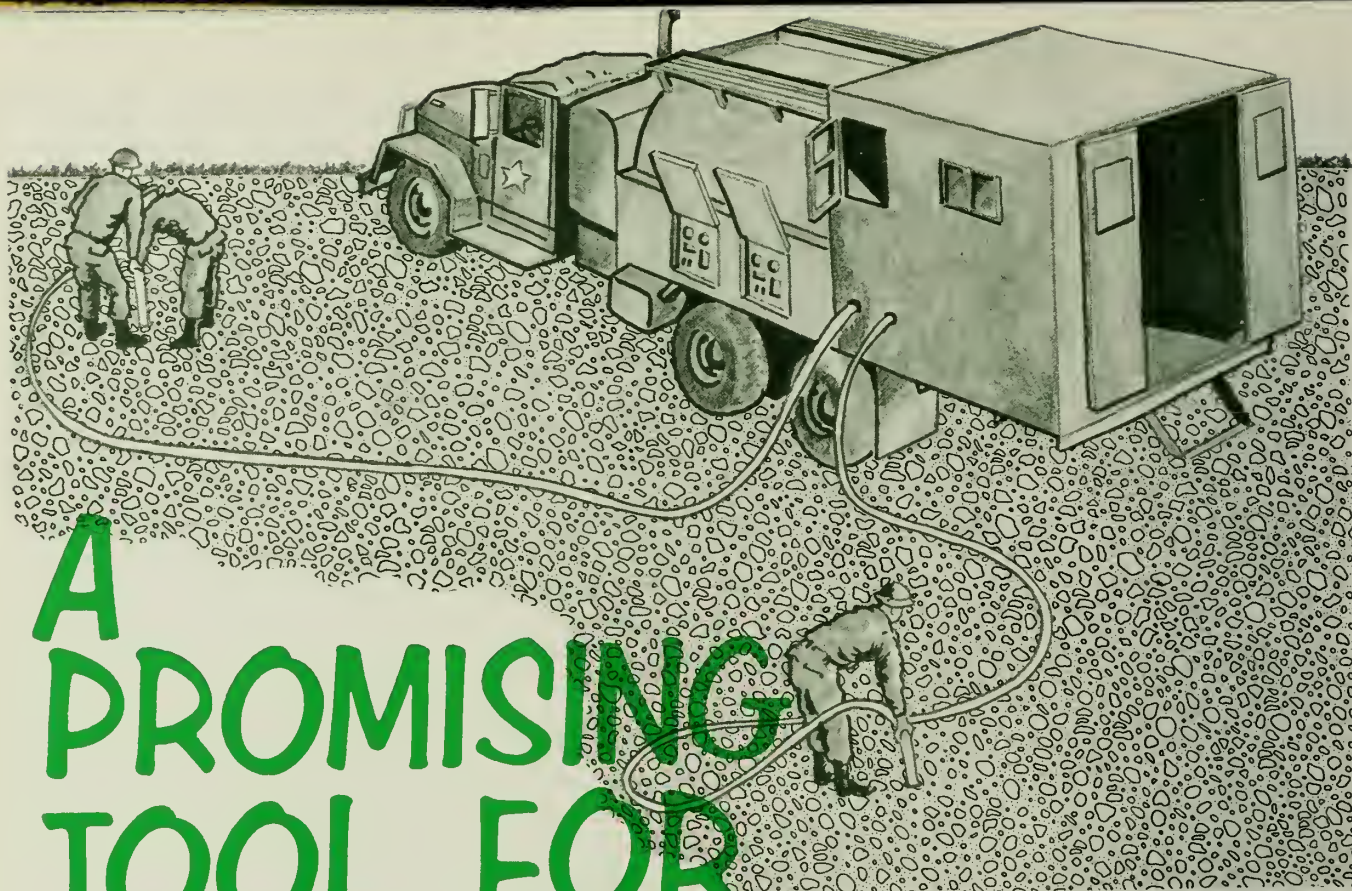
tick (Mass) Laboratories (NLABS).

The APBI is designed to obtain maximum industry participation in TROSCOM's continuing efforts to keep pace with future troop requirements, by providing encapsulated information on the Command's R&D programs, problems, assessments, forecasts and objectives.

The Honorable Norman R. Augustine, Assistant Secretary of Army for Research and Development, was the banquet speaker, March 26 at the Fort Belvoir Officers Club. Major General Hugh R. Higgins, TROSCOM Commanding General gave the keynote address.

Colonel T. R. Hukkala, MERDC Commander, introduced the Center's presentations with an overview of its facilities and projects followed by Terence G. Kirkland, Technical Director, who discussed the MERDC Technological Long Range Plan. Col. Robert Chant, NLABS Deputy Commander, reviewed their programs, and James H. Flanagan, Deputy Technical Director for Engineering, presented the Natick Technological Long Range Plan.

MERDC topics will include countermine, barriers, counterintrusion, bridges, watercraft, water and waste management, camouflage, electrical power, combat construction equipment, environmental control, materials handling, fuels, and fuels handling. Natick briefings covered personnel armor and individual equipment, airdrop systems, shelters and personal hygiene concepts.



A PROMISING TOOL FOR THE ENGINEER

Major Joseph Briggs

Let's say you just got the mission to destroy a railroad tunnel. You pull out your demolition bible, your trusty FM 5-25, turn to page 4-57, and there's the answer to your problem — or is it? To effectively neutralize the tunnel, the FM calls for eight 750-pound high explosive charges placed in chambers drilled into the rock. Of course, most engineer units are equipped to rapidly produce the required cavities! However, regardless of the time required to perform this task, it must be done since the doctrine brings out the fact that most other methods are impractical because of the large quantities of explosives required. Even with eight 750-pound charges, one-hundred-twenty 50-pound boxes of C-4 must be handled.

There's got to be an easier way, right? Well, if you could ever get clearance, you might consider using an ADM. Never happen, you say. Let's hope not, but in the meantime we still must get rid of that tunnel.

As you might have guessed by now, this guy has got some new blasting technique up his sleeve. The Army is looking at a new family of explosives called slurries. Actually, slurries aren't all that

new. The commercial blasting and mining industries have been using them successfully for more than 15 years.

When earthmoving and rock hauling equipment started getting bigger and bigger, until they reached the point where they could handle 20-, 50-, or even 100-ton loads, the amount of blast rock needed to keep pace became enormous. Mining engineers could no longer rely on cartridged dynamite to keep up with the demand. Explosives that could be easily handled in large quantities were needed.

It was discovered that by adding a small amount of fuel oil to pelletized ammonium nitrate (a common fertilizer) one obtained an excellent explosive for production blasting. ANFO (ammonium nitrate and fuel oil) is much safer than dynamite; it was cheap, and it could be handled in bulk quantities almost like a liquid. Unfortunately, it had a few drawbacks. ANFO has a low density; therefore, it requires a larger volume than dynamite or TNT, for example, to produce the same results. Worse than that, it is hygroscopic; i.e., it absorbed moisture, and therefore could be used only in dry drill holes.



30,000 CY cut after 300 hours of shaping effort by heavy equipment.

An ammonium nitrate based explosive is no stranger to the Army. For more than 30 years Uncle has been procuring the 40-pound cratering charges commercially. The primary ingredient of these charges is a dry mix ammonium nitrate with a high explosive booster. Possible underwater employment of the cratering charge dictated that it be manufactured in a waterproof metal canister.

In the early 60's, it was found that by adding water to ammonium nitrate along with suitable stabilizing and gelling agents, not only were most of the drawbacks of ANFO overcome, but handling of the resulting explosive was simplified.

These water-based ammonium nitrate explosives are called slurries or water gels. They vary in consistency from a heavy paste to a solid rubbery mass, depending on the gelling agents used. The gelling agent insures a homogeneous mixture by preventing settling of components and

it facilitates handling. Slurries can be formulated so that they can be pumped in a liquid state into a drill hole — thereby filling the entire hole and coupling directly with the medium — after which they set up a more solid consistency.

A simple slurry is one in which the fuel oil found in ANFO is replaced with another fuel that is compatible with a water gel. Most commercial slurries consist of an explosive base, such as ammonium nitrate or sodium nitrate, and a fuel, such as carbon, sulfur, or aluminum. Some slurries use a high explosive such as TNT as a sensitizer, and these are classified as slurry high explosives. The majority, however, contain no high explosives and are classified as slurry blasting agents.

The addition of large quantities of aluminum produces a slurry with very high energy release at moderate detonation pressures. The presence of aluminum lowers peak pressures, but provides

higher sustained gas pressures during the explosion.

Thus, slurries represent not just one specific explosive with a given set of properties, but a wide range of products with a varying set of explosive properties.

Slurries can be obtained in a variety of forms. They can be pre-packaged in polyethylene "sausages" in amounts of a few pounds up to a few hundred pounds. Or they can be mixed on-site in a special truck-mounted unit, which also pumps the slurry into the emplacement cavity. Commercial mixing-pumping units are capable of handling loads up to 50,000 pounds.

What this potentially means to the military engineer is that he could obtain and easily emplace slurry explosives in quantities as small as a few pounds or as large as several tens of tons. Moreover, he could specify certain properties that the slurry should have to best match the job that needs to be done.

Research is currently underway at the U.S. Army Corps of Engineers Waterways Experiment Station (WES) and the Army Material Command (AMC) to develop and evaluate, for military use, a family of slurry explosives that are capable of performing in both combat and construction roles and that can be dispensed from a commercial portable mixing and pumping unit. With this system, the military engineer would be able to choose the best slurry mixture based on the requirements of the job (e.g., high energy and shock pressure for breaching hard materials or moderate energy and high gas pressure for cratering). It is envisioned that the slurry would be mixed either on-site or at a central location from a series of inert, nonexplosive ingredients (which individually would require no special storage or security arrangements).

The slurry would be delivered to the job site in either prepackaged form or in the mixing-pumping unit. It would then be placed in the proper configuration for detonation by hand or by pumping. Detonation would require using a small high explosive booster, such as C-4. The slurry system in field operations would require logistical backup not unlike a concrete batch plant. But the resulting explosive system would be much safer and more versatile than the present Army system.

Slurries would not replace military explosives like C-4, but they would make an excellent substitute for the 40-pound ammonium nitrate cratering charge, since it appears that after this year the cratering charge will no longer be manufactured commercially in the United States. Slurries would also give the Army the capability of using explosives to do jobs not now considered feasible.

The fact that slurry can be easily used in very large quantities means that large scale explosive excavation tasks would be possible. Craters 20 feet and 100 feet across could become standard in barrier systems. Explosive excavation of road cuts, harbors, canals, storage reservoirs and other engineering structures would be possible at considerable savings in time and manpower over conventional construction methods. Demolition missions that require prohibitively large quantities of conventional explosives, such as the tunnel destruction job mentioned earlier, would become much less difficult. In brief, slurries could introduce a whole new technology into military engineering.



Hand loading of a slurry. The plastic bag is slit and the slurry is allowed to slide into the emplacement hole.

About this time you will probably be saying that all this sounds very interesting and fanciful, but who's to say that any of these ideas will work.

For the past several years many of these "fanciful concepts" have been examined theoretically and practically by WES through its Explosive Excavation Research Laboratory, ERRL. Formerly called the Nuclear Cratering Group, ERRL has conducted a series of projects using slurry explosives to perform construction and combat engineering tasks.



This is a typical slurry mixing and pumping truck. The truck is pumping a slurry explosive into water-filled holes.

One of the first major projects was the construction of a small-boat harbor at Kawaihae Bay on the big island of Hawaii. Twelve 10-ton charges of an aluminized ammonium nitrate slurry were used to excavate a channel and berthing basin 12 feet deep in the coral bottom. The charges were buried about 40 feet deep and about 100 to 120 feet apart.

Construction of a dam near Trinidad, Colorado, required the relocation of a railroad line. The new alignment passed through a series of hills and required cuts in excess of 20 feet deep and 400 feet long. Twelve 2-ton and twenty 1-ton slurry charges were used to excavate 18,000 yards of sandstone for one of the cuts. Not only was the job done in considerably less time than would have been required by conventional methods, but it was also done at much lower cost.

Slurries have successfully excavated craters that are impassable to tactical vehicles and demonstrated their usefulness in creating obstacles and barriers. In the fall of 1971 and 1972 Projects ARMOR OBSTACLE I and II were conducted in the Bearpaw clay shale near the Fort Peck Reservoir in Montana. They were conducted to evaluate on a go-no-go basis the obstacle effectiveness of the slurry produced craters and to evaluate and improve upon the existing prechamber barrier concept and the Army's deliberate road crater technique using slurry explosives. The explosive and equipment tested ranged from 240 to 4000 pounds and from the M151A1 Jeep to the Army's main battle tank, the M-60. In all cases, the craters produced were classified as effective obstacles. The pre-chambered craters proved to be extremely effective. Not only was it impossible for the tank to exit this crater even after attempting to maneuver in it, but remedial dozer action proved only marginally effective and quite time consuming. From these initial tests it ap-

pears that with the employment of slurry explosives serious consideration can be given to modifying the standard deliberate road crater design by reducing the number of emplacement holes and thereby saving valuable emplacement time and manpower.

Project ARMOR OBSTACLE II is the first of a series of experiments geared to investigate specifically the feasibility, design, and employment concepts for utilizing slurry explosives for creating barriers to impede enemy movement, destroying targets (such as dams, bridges, and culverts), and improving military engineering construction techniques.

The name "Explosive Dredge" may be familiar to many engineers who were in the Mekong Delta of South Vietnam in 1968. This is the name of a project conducted by the Navy, that was testing line charges made of packaged slurry sausages for producing and widening canals. Results of this program were also very successful. Using 20 pounds of slurry explosive per linear foot in less than 12 inches of water, the research team was able to produce canals 20 feet wide and 4 feet deep.

As recently as early June, tests with slurry explosives were completed near Huntington, Pennsylvania, in conjunction with the 176th Engineer Group of the Virginia National Guard. The tests examined the effectiveness and usefulness of slurry explosives compared to the 40-pound cratering charge. Once again, the "jelly goo," as referred to by several of the guardsmen, produced some excellent craters.

There is no scheme or devious plan to revolutionize military engineering by the employment of slurry explosives. However, it is fairly obvious that this commercial explosive could provide the engineer with a powerful tool, well-suited to tomorrow's battlefields.

Major Joseph Briggs is assigned as the Assistant Chief of the Planning and Research Division of the Explosive Excavation Research Laboratory, a laboratory of the U.S. Army Engineer Waterways Experiment Station. He also serves as the Station's coordinator for the Military Engineering Applications for Commercial Explosives. His troop assignments have included company commander, and atomic demolition munition team leader with the 86th Engineer Battalion (Combat Army) at Fort Dix, New Jersey, and as chief of advisory teams with the 539th Engineer Battalion in Vietnam and Thailand. He also served as executive officer of the 20th Engineer Battalion in Vietnam. He holds the B.S. degree in Architecture Engineering from Hampton Institute, Virginia, and the M.S. degree in Civil Engineering from the University of California.

AN AIT APPROACH TO DYNAMIC TRAINING

Colonel Maurice D. Roush



New Pilot Advanced Individual Training (AIT) programs at Fort Leonard Wood, Missouri, concentrate upon the soldier as an individual and are aimed at increasing the skill and motivation of graduates. The conditions which existed during the Vietnam era favored the unskilled approach, and the rapid turnover in the Army did not favor the long-term motivational aspects of training. Now, however, the needs of a volunteer Army make it essential that we produce multi-skilled and hence flexibly employable soldiers.

Long range economies in keeping our field forces up to strength also necessitate turning out career motivated soldiers. Both goals can be served by clearly demonstrating early in a soldier's career that achievement yields tangible rewards.

Most AIT courses now are geared to a uniform rate of learning by all trainees. This results in a de-facto penalty for the more adept trainee or the man with previous experience. He is slowed to the

rate of the less adept and, in our experience, is often severely frustrated in the latter part of the course. Yet, he is precisely the man upon whom we should be concentrating and providing an incentive and a reason for making the Army a career.

With these thoughts in mind, a pilot program was devised at Fort Leonard Wood early in 1973 to seek a more responsive method of training engineer soldiers. The program was coordinated with the Engineer School and subsequently approved by the U.S. Army Training and Doctrine Command at Fort Monroe, Virginia.

Entitled "Incentive Training," the program uses a modified selfpaced approach with add-on modules for those who complete early. The seven-week Crawler Tractor Course (MOS 62E) was selected for conduct of a four-cycle test. Under the program, trainees who can pass the standard performance tests in three weeks also can learn to operate scooploaders and wheeled tractors. Those

graduating in four weeks also can learn the motor grader, and those graduating in five weeks also can learn the wheeled tractor. Individuals who required the total seven-week period to learn the crawler tractor remained in the course for that period and standards were not relaxed for any of the testing. Equipment and instructor constraints precluded use of a true self-paced mode of instruction, hence the three, four and five week testing points.

Consideration was given to restricting the pilot program to only a modified self-paced approach without the add-on training. Such an approach offers the clear advantage of earlier delivery to units of at least some of our trainees. However, the incentive and motivational advantages would have been impaired severely or completely destroyed. It was considered essential to be able to offer the higher achievers a reward for their intensified efforts and thus begin early to prove to the soldier that the Army does reward achievement.

The pilot Incentive Training program began last September and has been monitored closely by the Engineer School, Human Resources Research Organization (HUMRRO) and TRADOC. Improvements to the initial program were put into effect as soon as they were recognized as desirable. For instance, the original concept included self-paced testing only at the end of the third and fifth weeks and limited add-on training to the scoop-loader and wheeled tractor.

Shortly after the first cycles, it became apparent that the program would benefit by adding testing at the end of the fourth week and providing grader operator add-on training. Also, the third week testing, which had been mandatory, was made voluntary. The proportion of trainees passing the mandatory third week test had been small and it appeared that this early testing might be counterproductive for the less adept. Since the change, about 25 percent of the trainees have volunteered for the third week test.

The success of the program is demonstrated by the fact that TRADOC authorized its extension on an "as is" basis pending completion of analysis and final recommendations. Further, HUMRRO has been directed to concentrate its efforts on the Crawler Tractor Course to assist in attaining optimum results.

While the analysis of the Incentive Training pilot program is not complete some observations are in order based upon the first four cycles. They show that —

- A significant number of our trainees are capable of learning to operate more than one piece of equipment in seven weeks. So far 10 percent have learned three pieces of

equipment and 53 percent have learned two.

- All command indices, such as sick call and AWOL rates indicate the program is producing a better motivated, more soldierly graduate.
- On-site, groups of trainees coaching each other has become prevalent.
- Those trainees who still require the entire seven weeks to learn to operate the crawler tractor have not become discouraged. To the contrary, the failure rate has decreased.

Perhaps the most encouraging aspect of the Incentive Training program lies in the field of trainee attitudes. All chain of command personnel associated with the program have noted a striking upswing in trainee eagerness and motivation in all aspects of soldiering. As an example, the Crawler Tractor Course consistently surpasses the other 15 Engineer MOS producing courses combined in having its members selected as the outstanding soldier of each day's Brigade guard.

Gaining commanders are being notified by letter on an individual basis of those trainees who learned to operate additional equipment. Feedback has been requested from the field to help assure responsiveness to the needs of TO&E units.

An Incentive Training pilot program along similar lines also has been devised for Pioneer AIT (MOS 12A10) and was launched for the first time on March 17, 1974. TRADOC authorized four cycles of seven weeks duration. After the fourth cycle is completed the program will be evaluated to determine whether it should be adopted permanently.

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LET'S GET BACK ON THE TRAINING TRACK

Captain Guy R. Varchetto

The experts say that the training program at the unit level in the U. S. Army and, of course, the Corps of Engineers is deteriorating today at a progressive rate rather than improving. Why?

There are several reasons. Perhaps the most significant is the sad fact that the company commander has too many problems to solve during a normal work day to give the unit training mission the emphasis it needs. This officer runs a hotel, a restaurant, a motor pool, a supply activity, an administration center, a rehabilitation program for drug and alcohol abusers, a civilian education program, and the "decentralized training concept."

What is this thing called "decentralized training"? Well, way back in 1971 former Army Chief

of Staff William C. Westmoreland sent a revolutionary message to the field that said all commanders were to take immediate steps to "decentralize training" and begin making it "dynamic." What he really was saying was that he wanted to throw the old classroom training schedules out the window and get down to basics where the individual soldier could identify with the program. This put the onus on the company commander at a time when he did not have either the resources or the time in which to get the training task done.

So there were a bundle of problems attributable to the new concept. Here are just a few —

- Most TOE units are understrength in key

personnel. This places a heavier load on the officers and noncoms to absorb more of the additional duties than they would normally share if the unit were operating at full strength. This simply adds up to the fact that when all of a unit's functions are accomplished by less than the number of people authorized to get the job done there is a proportional loss of efficiency.

- TOE units were designed to accomplish specific functions or missions and were authorized only enough personnel and equipment to carry them out. No TOE/TDA allows for special training devices at company level or specialized personnel in this field but most companies try to maintain the materials necessary to support a training operation by detailing an NCO and a clerk to the task.

- Officers and noncoms detailed to training are responsible for the conduct and behavior of their men. Leadership and training are overlapping areas to a great extent. Both areas demand a great deal of time and effort. The officer or noncom who plans and conducts his training to the best of his ability has no recourse but to deny his personnel a degree of the leadership they require. Our soldiers must be led, motivated, and assisted throughout their tour of duty no matter whether it is for two or 20 years. We cannot achieve these objectives by denying them leadership.

- Most noncoms assigned to line units as squad leaders or platoon sergeants have had little if any formal training or experience on how to be an effective instructor. Our noncoms have been trained and have acquired experience in the principles of leadership. They may have the necessary knowledge but that does not make them automatic instructors.

- It is said by some so-called military experts that the soldier enlisting in today's Army leaves a lot to be desired. This may or may not be true but he certainly is better educated than his predecessors. This being the case, he is able to detect that his squad leader and platoon sergeant may not have the ability to be instructors. After he realizes this basic fact, the soldier becomes less receptive to the training and often has a tendency to ridicule his superiors who are making genuine attempts to conduct proper training.

There are a number of other reasons why the "decentralized training concept" is not working up to original expectations. Perhaps the main point is that it does not work. The Army can continue to demand results with little chance of getting them. People can continue to write and rewrite circulars and regulations to clarify the program. Or the Army can face the facts and attempt to do something about them. Since it is highly unlikely that the present "pass the buck" training concept

will cease to exist, it is high time to give the unit commander some guidance and suggestions he can use to accomplish the mission.

Decentralized training does have one thing going for it. This is the realization that the unit commander knows best what his strengths and weaknesses are and therefore knows where he ought to be concentrating his training program. With this thought in mind and an awareness of the problems with the current training policy, there is a way of improving training immensely without restructuring the Army from the Chief-of-Staff down to squad level.

There is nothing remarkably new about the proposal that is being offered here to alleviate the training problem. It parallels the old committee training concept slightly but differs considerably in organization and function. In the past, the battalion S3 grabbed a few special duty people who worked up lesson plans, published schedules, and conducted training for three soldiers when 300 were programmed for the class. Instead of this plan, why not try committee training organized in such a manner as to embody professionalism, unit integrity, teamwork, job satisfaction, and leadership. This concept can be adopted by nearly all TOE units of battalion size. However, separate companies and some units performing support functions may have difficulty implementing a program of this nature.

Committee training, as envisioned here, is still decentralized down to battalion level. There are four steps that must be taken to implement the program. First, determine the training requirements; second, select and equip the committee; third, prepare a training schedule; and finally, put it to work. Let us examine each step in succession:

- **DETERMINE TRAINING REQUIREMENTS** — In any given TOE battalion with four line companies, the training requirements would be the same. Since the company commanders are the best judges of their training needs and the S3 is read in on the battalion's requirements, they need to have meetings to determine and agree upon the training requirements for the entire battalion. This could take up as much as two weeks time and require several meetings. The S3 should list major areas that require attention. Then the unit commanders should present their problems and contributions for consideration in the development of the finalized list. These areas would then be broken down into sub-areas requiring concentrated attention. The S3 and the unit commanders would then discuss each and every major and sub-area and reach a decision on the amount of training that would be required for a given subject. When each subject area is

completed the S3 would add it to a list which, when completed, would constitute the unit's master training program. This would give the unit a basis from which to work.

• **SELECTING AND EQUIPPING THE COMMITTEE** — Under this concept, each company in the battalion would be required to attach one full TOE squad to the battalion S3 for the express purpose of conducting the training program. These squads would be staffed with the best personnel available in each company. To insure professional staffing, the battalion sergeant major would be required to personally monitor the assignment of enlisted personnel to the four squads. In addition to "cream of the crop" staffing, each squad would be equipped with 100 percent fully operational tools, vehicles, and equipment authorized by the current TOE/TDA. The four squads would become the training committee for the battalion. Their mission would be to work directly for the S3 and conduct the battalion's training program. This would be done on an individual, squad, or platoon basis. Under the direction of the S3, the squad leader and his personnel would prepare lesson plans, research study material, coordinate utilization of training areas, support their instruction with organic equipment and manpower, and receive guidance from the operations officer for all support beyond their capabilities. The training committee would handle the program for six to nine months before being replaced by different squads. The professional staffing that was used when the program was established would insure its success. Succeeding squads would be able to draw on the lesson reference files, training aids, and experience developed by the first group of squads.

• **SCHEDULING** — Determining training requirements and the organization of the training committee should take place simultaneously. As soon as both functions are completed, the four squad leaders would report to the S3 for a briefing on the training objectives. The S3 would then assign each squad leader his share of the training subjects. Each squad would be given one month lead time in which to prepare lesson plans, study and research subject material, and finalize the training program. During the third week of the month, the squads would begin a series of rehearsals with the S3 to refine the instruction. It is not anticipated that each squad would present 40 hours of instruction each week or every other week. The S3 would plan the training schedule to coincide with the normal operations of the battalion in a way that would allow every squad or platoon in the unit to rotate through the required subjects within the desired time frame.

• **PUT IT TO WORK** — After the first three steps have been completed the battalion would be ready to start its training program. Then it would be up to the first line supervisors in the unit to read the schedules and insure that their personnel attend the required training sessions. Also all junior officers and noncoms should attend the training sessions with their men. It should be mandatory that they attend the sessions since the burden of conducting the training would be on the instructors. Their prime mission would be to get their personnel to the training site. Their other requirements, of course, would be to offer assistance to the instructor and provide overall supervision for their men, if necessary. This program comes under the heading of leadership and teamwork. This way the supervisor is a supervisor and the instructor is an instructor. Neither one is a mixture of both. Can there possibly be a better arrangement for a training program?

It should be understood that the training committee could not be required to conduct 40 hours of training each week. Just how much training each squad would conduct would be up to the S3, the company commanders, and the capabilities of each squad of instructors.

What happens to the rest of the week? Well, the company commander could now concentrate on the routine program of running his unit the way it should be run. He would now have time to conduct motor stables, command information classes, hold inspections, and maintain his living and working areas. By not having to concern himself with sponsoring the training that the training committee would be handling, the unit commander could now run his unit in a much better fashion than most are being run today. It certainly would be run with less effort and strain for all concerned.

Just imagine how much better these units might be if the commanders were able to spend the same amount of effort and strain they are putting forth today only in the areas that need so much of their attention. Let us hope they will be able to do just that tomorrow!

Captain Guy R. Varchetto is the Commanding Officer of Headquarters and Headquarters Company, 7th Engineer Brigade, U. S. Army Headquarters, Europe. The article he presents here for THE ENGINEER is a modification of a suggestion he submitted to the command some time ago. He wrote that "it is almost taboo to speak out for any type of training other than the current "Decentralized Training Concept" here in USAREUR." It is hoped that this topic will generate some controversial discussion on current ideas regarding training in the Army today.



THE "NEW" RELIABLES

Captain Leroy L. Saage

Have you ever looked with nostalgic envy at a replica of a 19th century frontier recruiting poster? "Captain Kit Carson is raising a troop of cavalry to join the 7th Cavalry Regiment. Join Now!"

The chance to raise and train a unit seemed lost to the contemporary Army until the 9th Infantry Division came on the scene at Fort Lewis, Washington. And with it came still another opportunity new to most officers and non-commissioned officers — the chance to conduct Advanced Individual Training within a tactical unit.

This is the story of Company D, 15th Engineer Battalion (Combat), and its efforts in recruiting and training within the 9th Division. The 9th was reconstituted at Fort Lewis after service in Vietnam and designated a unit-of-choice division. Since it was manned at only cadre strength, those present to watch the colors uncased knew they had to recruit the balance of the division. Rumor has it that the then Army Chief of Staff, General William C. Westmoreland, said to the new Division Commander, Major General William F. Fulton, "If you want a division, Bill, go out and get one."

Though the recruiting effort was organized and controlled from division level, it was up to each company commander to screen, select, indoctrinate, cajole, and dispatch non-commissioned officers from his company to recruit the engineer soldiers he needed to up-grade his command from reinforced squad to company. Though non-commissioned officers were used exclusively at

first, once the division had trained some new recruits, many of these were selected as Hometown Recruiters to return home and recruit their friends. Creditability was the by-word in the recruiting effort. The "Madison Avenue" approach was discarded in favor of a tell-it-like-it-is attitude. We might have recruited fewer men, but the ones who enlisted had a pretty good idea of what they were getting into. In an effort to better tell the engineer story, a special engineer display and recruiting team went on the road for six weeks in key western states to supplement the regular program. Although statistics varied with each Recruiting Main Station visited, all enjoyed a marked increase in recruiting during the time the engineer team was with that station.

Members of Company D not actively participating in recruiting also were not idle. All the other chores associated with cranking up a new unit had to be done. Barracks were upgraded, offices set up, and the company maintenance area and bridge park had to be organized.

By far the most demanding task was planning and preparing the in-unit advanced individual training program. Maximum use was made of the decentralized training concept with the company commander making most of the decisions concerning what the recruits would be trained to do and how they would be trained. Army subject schedules were used as guides, but originality and creativity were key elements by which the training program was judged. Strong emphasis was placed



on making the training task-oriented and its conduct primarily hands-on.

Any training program has the requirement of supervision and validation of assimilated skills and knowledges. Thus is revealed one of the attributes of in-unit AIT as opposed to the training center variety. When new soldiers arrived in the unit, they were assigned to the section and platoon with which they would remain while in the company. The chain of command responsible for their discipline, morale, and mission accomplishment, also was responsible for training. Leaders are apt to be more conscientious in training when their later reputations will depend upon how well their charges perform.

Building this habitual association of leaders and recruits began the first day the new arrivals reached the unit. The "New Reliables" (derived from the 9th Division motto, Old Reliables) were not glad-handed but were made to feel welcome and were given every assistance in settling into their new home. The section sergeant was the key man in the life of the New Reliable. He was the primary trainer, advice giver, and motivator. He was also an infinite source of information. The section sergeant insured that each New Reliable was assigned a "buddy." The "buddy" helped orient the new man to post facilities and participated in peer training. The greatest value of the buddy system, however, was the marked reduction in off-post assaults and robberies normally committed against lone soldiers. Genuine effort was made to maintain responsiveness in the chain of command. Discipline is based upon confidence, and confidence is built in part by reasonable redress of grievances.

The acid test of the entire concept came in the actual conduct of training. The company wanted to emphasize and properly develop individual engineer skills while simultaneously maintaining small unit integrity. This idea was far easier to talk about than to implement. A few general guidelines were finally decided upon. First, the base training unit would be the platoon. Each platoon attended training as a group and usually would not be training in the same subject area as another platoon. Secondly, introductory and explanatory phases of training would be directed toward the individual soldier while practical exercises would be conducted as a platoon. Thirdly, qualification tests usually involved a platoon mission with each member demonstrating skill in a specific area of that mission. Lastly, the final test before graduation was of the situation-reaction type. Each soldier was presented with a situation, an array of equipment, and graded upon his selection of equipment and manner of solving the stipulated problem.



**THE CORPS NEEDS
YOU!**

The shortcoming most frequently pointed out by detractors of the decentralized AIT-in-unit concept is the loss of efficiency. Their argument is that a training center, with its large training budget and training cadre, can better train a soldier in individual skills. An instructor who teaches only one subject will be more proficient than a squad leader or platoon leader with myriad other responsibilities. This argument is certainly legitimate.

But let's look at the Army's training objectives in their order of priority. These objectives are: (1) military discipline, (2) teamwork, (3) health, strength, and endurance, (4) tactical proficiency, and (5) technical proficiency. Examination reveals that the efficiency provided by a centralized training program has its greatest impact in only one area — technical proficiency. It is last in priority. The strength of the AIT-in-unit concept is that it most directly addresses itself to the first four objectives. Many of us would do well to remember the maxim, "First a soldier, then an engineer."

It was mentioned earlier that the bulk of training was to be hands-on. This may deserve some expansion. Hands-on training means simply that a soldier learns a skill by actually practicing that skill rather than hearing about it in a classroom. Some of the more complex subjects required introductory classroom time, but by far most of the soldier's time was devoted to learning by doing.

Additionally, training was structured around

attaining a desired skill level demonstrated through accomplishing a particular task at the end of the training block. The master training schedule provided guidelines in the form of an estimated number of hours required to teach a specific block of instruction. The training schedule fluctuated depending upon how well the new engineer soldier learned the required skills. This was possible because the 9th Division allowed up to 13 weeks to complete AIT and the normal platoon required around eight or nine weeks to train. Once AIT had been completed, opportunities were made available for specialized training geared to meet the personal needs of the individual.

Engineer soldiers in less glamorous MOSs were allowed to cross train as heavy equipment operators or in other technical skills in high demand in the civilian job market. And of course for those soldiers looking for a little excitement, the Northwest with its challenging river rapids and scores of mountains offered virtually unlimited possibilities for adventure training. The 9th Division may well have the only bridge company in the Army that is capable of conducting ski-borne bridging operations, if there is such a thing.

Many of the enlistees looked toward the Army as a means to upward mobility. In support of these efforts, the 9th Division established the "Old Reliable University." Through the "University" soldiers were allowed to attend courses taught through civil institutions during duty hours. Classes were taught on post and offered vocational, high school, college, and graduate school courses. As an example, a soldier entering the 9th Division with a high school education could earn an Associates Degree through Old Reliable University by the end of his guaranteed sixteen months with the division.

What has been presented here is one company's experience with recruiting and training in the 9th Division. While not universal, many of the concepts discussed here are applicable to all tactical units. Decentralized recruiting and training bolster teamwork and esprit-de-corps and provide true satisfaction for the leader.

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The combat readiness of any unit is dependent on three factors: personnel logistics, and training. A unit may have an acceptable troop strength and enough equipment to outfit its troops, but if the troops are not motivated and proficient in their assigned responsibilities, the combat readiness of this unit is apt to be marginal. It is for this reason that leaders at every level should be aware of the type of training the replacement stream personnel are receiving.

The majority of replacement stream personnel are trained in the U.S. Army Training Centers or service schools throughout the continental United States. For Engineer soldiers this center is located at Ft. Leonard Wood, Missouri.

Most soldiers who entered the service during the last 10 years remember the second phase of formal training, Advanced Individual Training (AIT), as an eight-week extension of Basic Combat Training with a few written examinations scattered at random throughout the training cycle.

The product of this type of training, more often than not, was a soldier proficient at answering multiple-choice questions. Once removed from this sterile environment, he was lost in the real world when his choices were reduced to two courses of action — right and wrong.

Most soldiers in this situation were inclined to do nothing at all, since the consequences for taking the wrong course of action far outweighed the consequences for pleading ignorance and letting things slide.

Another fallacy with the old training practices was that there was no way to really build the confidence of the individual. After graduating from AIT, the soldier had the knowledge from the instruction presented, but he lacked the confidence to apply that knowledge.

Minnesota Metropolitan State College (MMSC), Minneapolis-St. Paul, Minnesota, has a method of instruction unlike most higher-learning institutions. This new type of state-supported school covers the final two years of college in a rather unique manner.

The instructors are from the professions, business, community services and so forth. These instructors do not necessarily have degrees themselves. The students work directly with these people in an apprentice-type training and are taught to relate their textbook knowledge to the world of reality.

Dr. David Sweet, President of the college, feels that pen-and-paper exams are too narrow and that experience in a chosen field, guided by an experienced person, is much better. Doctor Sweet has stated that it is not when and how the student has learned the subject, but rather that the student does know the subject. This new concept

TRAINING WITH A PERSONAL TOUCH

Captain Harold H. Scott

in education has been heralded as the wave of the future.

A system similar to MMSC's has been adopted by the Army and is called "Performance-oriented Training." This is a dynamic and motivating training administered with advancement based on individual progress. How does this system differ from the old? Well, for the Engineers it takes less time. The new training cycle for most Engineer Military Occupational Specialty courses is seven weeks as opposed to the old eight-week cycle.

How can a better-qualified soldier be produced in seven weeks when the old system utilized eight weeks to produce a multiple-choice expert? The performance-oriented system is based on a go/no go approach. This means the trainee must actually perform an assigned task under the close supervision of an instructor in a satisfactory manner before he is allowed to continue to the next phase of training. This allows the faster learners to progress at a more rapid rate and slower learners to receive additional training to bring their level of performance to an acceptable standard.

The faster learners are utilized as peer-instructors to aid the slower learners. This coupled with a general streamlining of subject matter has brought about the shorter training cycle. This does not mean any proficiency is lost. On the contrary, less time is spent listening to lectures and more time is devoted to actual job

performance.

Performance-oriented training brings the replacement stream personnel up to an equal plane of proficiency. However, the individual training should not stop with AIT. Once assigned to a unit, this highly trained and motivated soldier must be allowed to maintain and even improve his proficiency by more specialized, operational experience. Performance-oriented training in AIT merely establishes a basis from which an individual can expand. It is up to every supervisor to insure that these individuals are at least afforded the opportunity to do just that.

Performance-oriented training may not be the sole solution to attaining a more-professional Army, but with the expansion of this type of concept to all fields of training and management, the goal of a more professional Army will be advanced.

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Readiness Is Spelled

Major Matthew J. Jones, Jr.

The drawdown in and subsequent withdrawal from Vietnam returned us to a peacetime Army — an Army replete with shifted priorities and the historically recurring condition of postwar austerity. The articulation of our national policy regarding future calls to arms was irrefutably brought into focus by the Secretary of Defense in 1970 when the Total Force Concept was enunciated. This concept explicitly includes the Reserve components in our military planning. It assigns the Reserve components a major role in the strategy of our National Security. Post-Vietnam reductions in Active Army strength effectively increased Reserve component strength.

Today's force structure profile puts nearly half of the Army's strength in the Reserve components (See Figure 1). This force distribution demands the high degree of emphasis being dedicated to the Reserve components. Unlike the "One Army" concept which never really got off the ground, the "Total Army Force" concept was forcefully conceived and is rigorously pursued. Emphasis and interest are much in evidence from the highest echelons of the Army to the lowest. The recent reorganization of the Army in CONUS is directly related to practical realization of the Total Army Force (See Figure 2).

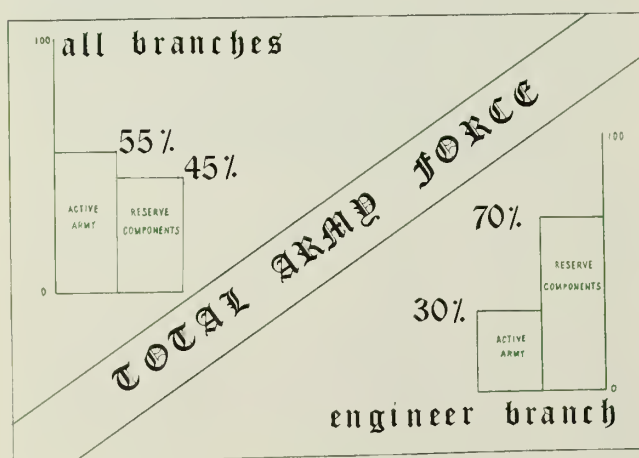


Figure 1. Total Army Force

Key features of this reorganization included —

- Metamorphosis of the Continental Army Command (CONARC) into two discrete elements, the Training and Doctrine Command (TRADOC) with individual training responsibility and the Forces Command (FORSCOM) with responsibility for unit training and readiness.

- Realignment of the CONUS Armies into three numbered Armies, — First, Fifth and Sixth — with the principal major mission of commanding and training Army Reserve units and supervising the training of Army National Guard units.

- Creation of nine Army Readiness Regions (ARR) and 28 subordinate Army Readiness Groups (ARG) dedicated to aiding the Reserve components to enhanced readiness through both branch and functional assistance teams (See Figure 3).

- Conversion of seven brigades from selected Training Divisions into Maneuver Training Commands (MTC), or mini-MAC's, which with existing Maneuver Area Commands (MAC) provide nine organizations, essentially one per ARR, to write, conduct and evaluate FTX, CPX, and ATT for Reserve component units.

- Establishment of training assistance programs by the Army training community specific-

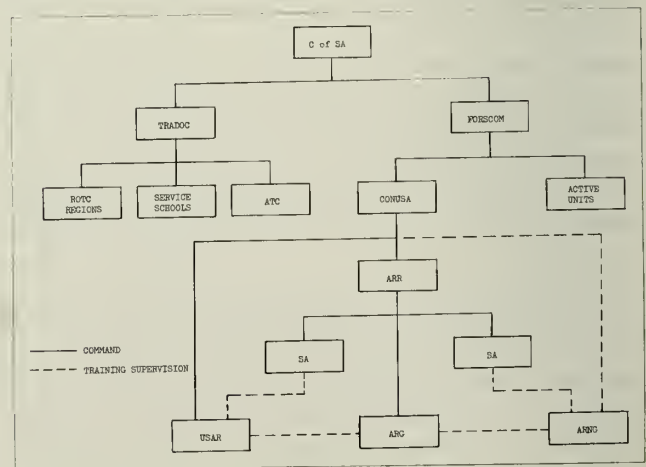


Figure 2. Reorganization of the Army in CONUS



Figure 3. Army Readiness Regions (ARR)

ly for the Reserve components.

Even before the reorganization of the Army began, however, many of the service schools had undertaken dynamic programs for supporting the Reserve components in their training. The U.S. Army Engineer School was among the first to establish an active, positive, coordinated program for the Reserve components. This program was to become an extension of the school's previous efforts but on a much larger scale.

In July 1972, the Engineer School initiated its Expanded Reserve Component Support Program with the specific mission of increasing the level of Engineer School support to and participation in Reserve component engineer training. This program derived principally from the dramatic picture of the force structure profile which had put approximately 70 percent of Total Army Force engineer resources in the Reserve components. The maintenance of a corps of professional military engineers, both individual and unit, for the Total Army Force and a full appreciation for the total training dependence of readiness compelled the Engineer School to invest many of its assets in the training of the Reserve components.

The considerable importance of the Reserve components was established in the force structure profile. But, the establishment of a responsive and viable support program was seen to be dependent upon an understanding of and appreciation for the distinctive characteristics of the Reserve components. There were and are clear differences between the two components which need to be recognized.

Unlike the Active Army, members of the Reserve components must approach their Reserve component duty as an avocation, not a vocation. This is reflected immediately in the amount of time available for training and in the scheduling of that time. The Reserve components must train at night, on weekends and frequently during their

vacations.

Peer pressure has a much more pervasive influence in the Reserve components than it has in the Active Army. Since Reserve component members function in a dual environment, they are more subject to the kinds of pressure brought to bear by their wives, civilian coworkers, civilian employers and social groups. The most cited reason for non-reenlistment in engineer Reserve component units is family influence.

While societal aspirations for a better life have touched the military at large, the impact of these aspirations have been very strongly felt by the Reserve components. To attract and retain personnel, the Reserve components find that they must offer their members an opportunity to make meaningful social contributions through community service projects. For the most part the Reserve components have done an admirable job in their approach to these projects. However, there is a tendency to get too involved in these kinds of projects to the detriment of mission essential military training. The Reserve components must find a reasonable balance between the two.

Although rapidly improving, the equipment status in many units is not good. Frequently, the units will not have the equipment at all, will have but a portion of their authorization, or will have obsolete equipment classified "contingency and training." It is difficult to train people to become proficient in their skills when there is no equipment with which to train.

Training facility availability is yet another thorn in the side of Reserve component units, particularly those located in metropolitan areas. Even assuming the availability of equipment, certain aspects of training become an area of concern when there is no place to operate that equipment.

Reorganization of units is an irritant which occurs too often. As force structures are changed members of units are reorganized from one branch to another. Unlike the Active Army, personnel in Reserve component units usually cannot be reassigned to another unit in their branch but must become qualified in a new branch in order to be retained.

Reserve component units are often heavily fragmented. Subordinate elements are split over state borders causing command and control problems which often have a detrimental impact on major unit exercises.

Yet another trait of the Reserve components is the limitation on upward mobility. A member is geographically bound to a specific Reserve component unit by virtue of the physical location of his residence. The opportunities to transfer to another unit for promotion advancement are

The phrase, "ONE ARMY," was coined by the Department of the Army in 1958. It was meant to be a succinct statement of a new Army goal, circa 1958. It reflected a desire and intent to merge the Active Army, the Army Reserve and the Army National Guard into a team with a shared mission of national defense. This was not really a new concept. It had been a long-standing concept, extant since the earliest days of the nation. Its newness lay in the expectation that the Reserve component share of the Army's total national defense mission was to increase with a concomitant reduction in alert-to-commitment time.

Fighting alongside their Active Army counterparts the men of the Army Reserve and the Army National Guard have served the nation well and valorously. But, to take nothing from their superlative performance in the nation's hours of need, the Reserve components had had time to mobilize, to supplement their capability with additional training, to increase their preparedness before commitment.

By 1958, however, technological advances had drastically compressed time and space. Concurrently, these same advances offered the collateral potential for a more rapid rate of destruction in the event of catastrophic war. Time to mobilize verged on becoming an anachronism. The scales which measured the balance of power in the world were in equilibrium, and were delicately held in that state by conference table negotiations. But conference table promises, as history so clearly shows, have validity only when that indispensable element of all successful diplomacy — a credible, deployable force in-being — exists to back it up. In retrospect that force in-being was a hypothetical One Army.

The One Army concept died aborning. It was never more than a hypothesis in the context of the time in which it was fostered. The concept was not then translated into accomplished fact. One Army represented a well-intentioned and essential concept. Frankly, however, it failed and in failing did immeasurable harm. An array of factors, each to a varying degree, caused its failure. The coiners were sincere, but command emphasis fell short.

The onus for success fell to the Active Army. But, while the ultimate goals of the Active Army and the Reserve components were identical, the Active Army by and large did not understand that the forces which drive the Reserve components in their day to day activities were different than those which impacted the Active Army. The Active Army, lacking an appreciation for these differences, insisted on "school solutions", solutions born out of Active Army experiences. In its rigidity the Active Army neglected to realize that there may be several varied approaches to a single end. Hence, inflexibility and the impatience it generated contributed to the failure of the concept to be translated into reality.

Still, the concept may have strained to fruition had not the Vietnam conflict arisen. The exigencies of the times intervened, however, and the attention and efforts of the Active Army were diverted.

In the final analysis the Reserve components were offered through the One Army Concept a remarkable opportunity and responsibility which they were willing and eager to accept. Unfortunately, the Active Army gave it a great deal of lip service and very little affirmative support. In the process the Active Army lost a large measure of its credibility with the Reserve components, for much had been promised but little delivered in the name of the One Army. For all practical purposes the One Army concept was dead, barring a dramatic reincarnation.

limited.

Reserve component units have consistently demonstrated that they are deficient in focussing on and delineating their training needs. Whether the units do not recognize their shortfalls or whether training deficiencies are overshadowed by more visible difficulties such as personnel turbulence, and equipment and training facility inadequacies, which have been reported, is not certain. But, it is suspected that one of the most salient and most undesirable characteristics of the Reserve components may influence such reporting or non-reporting. This has to do with the tendency of Reserve component units to operate in a shell, — their inclination to not work with other Reserve component units and their predisposition to avoiding self-criticism by admitting their deficiencies, especially in confessing their faults to a suspect Active Army. Breaking this shell will be a task of large proportion. But great strides have

been made in this area. This shell shows many cracks with many more developing daily. What is significant here is that these cracks are self-generated. The Reserve components are now looking outside of themselves to prepare for readiness and their expanded role in the National Strategy.

Because the wherewithal to accomplish the mission of training support to the Reserve components was recognized as a principal constraint, the identification of resources and means was recognized as being critical to the development of an effective and efficient program. Figure 4 enumerates the resources and means which were identified. What are these means?

The first means is Organic Instruction. Units have always prepared their own lesson plans using DOD, DA, Engineer School and whatever other pertinent references they could find. This will continue. However, in view of the limited time which Reserve component units have for training

preparation, it helps them greatly to use the prepared instructional materials stocked by the service schools. The group study approach to correspondence courses is an excellent training vehicle but has not been pursued to any great extent. Interest in the group study correspondence course format has been on the increase and is encouraged because it can be supplemented with live instruction and hands on, performance oriented training.

USAR schools play a significant role in Reserve component training. The Engineer School has been monitoring the USAR school instructional programs, providing them with instructional materials, advising Reserve component units of the USAR school availability and assisting host schools in presenting their AT programs. Additionally, the Engineer School supplements with its resident faculty the training of USAR School students by offering nonresident/resident phases of the Engineer Officer Advanced Course.

Several Reserve component units have contracted, usually through the USAR School system, with private civilian training institutions for the training of their personnel in hard skills such as carpentry, plumbing and electricity. The Engineer School has begun to monitor such actions with a view toward advising the Reserve components at-large on the successes, failures, advantages, shortfalls and procedures for using this training means.

One means which has always been available but little used is training interaction between Reserve component units. Since the entire objective of Reserve component training is to prepare for mobilization, it seems highly desirable that units which will be required to mutually support each other in time of conflict receive a fair amount of integrated training in peacetime. This way each could learn the other's capabilities and a mutual respect and confidence could be developed. The Engineer School urges this type of interaction between Reserve component engineer units and their sister branch units and is prepared to provide the necessary advice and assistance to support units which undertake this effort.

Active Army units and other organizations have been increasingly furnishing teams to support Reserve component unit requests for training assistance. This is good because it educates both the Active and Reserve components as to each others capabilities and fosters a healthier attitude among the various components.

The desire to train with Active Army units seems to be a common desire in the minds of Reserve component unit training personnel. This is done frequently during annual training (AT) but could be accomplished more often during weekend

multiple unit training assemblies (MUTA's) as well.

Mobile training teams (MTT) play a major role in the Engineer School's support of the Reserve components. The instructional departments, to include the Defense Mapping School, have provided teams in their areas of expertise and will continue to support the program with MTT. Additionally, both NCO and Officer Advanced Course students have been employed in an MTT capacity.

Resident instruction is an excellent training vehicle. That is as it should be since that is where the greatest expertise lies. During Reserve component inactive duty training (IDT), active

TRAINING RESOURCES AND MEANS

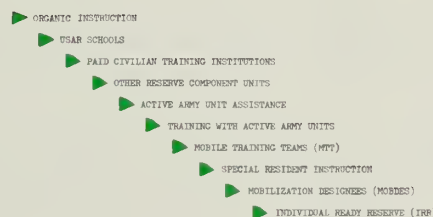


Figure 4. Training Resources and Means

duty for training (ADT) or AT unit members have the option of auditing resident classes on a space available basis. Additionally, the School offers unit oriented Special Non-POI Courses and Staff Refresher Courses on a request basis and individually oriented Special POI Courses on a scheduled basis.

The personnel assigned against the Engineer School MOBDES TD are located all over the country. Except for correspondence course work they have little opportunity to earn retirement points. As part of the program of maintaining communication with these men and assigning them training projects, they could serve as one-man mobile training teams. Several MOBDES personnel located in the Fort Belvoir-Washington area have indicated a desire to participate voluntarily in local MTT and special weekend course efforts. The Engineer School is planning to use them in the future.

One means which the Engineer School is exploring is increased use of the Individual Ready Reserve (IRR). Here is a vast pool of expert, untapped resources. The School is currently coordinating with the Reserve Component Personnel and Administration Center (RCPAC) to determine ways and means for making better utilization of

IRR personnel. The mechanisms are available. The TRADOC Liaison Officer, recently attached to the Engineer School, is investigating this means and is working toward developing a program that will identify and employ IRR in the training of both Reserve component and possibly Active Army units. In concrete terms, just what is the Engineer School doing in terms of training assistance?

Look at Figure 5. It is another perspective of the total program assembled by the Engineer School for the Reserve components. The training assistance available from the Engineer School falls into two general categories — direct and indirect. Indirect assistance consists of correspondence courses, the provision of instructional materials and a brokerage function which entails our coordinating with an ARR, ARG and/or a requestor in obtaining viable training assistance from sources external to the Engineer School. Direct assistance activities address principally the resident course subjects taught at the School. Insofar as possible, the common thrust of the School's direct assistance efforts is to help a unit become self-sufficient in its training.

There are four direct training assistance activities. First are the mobile training teams or MTT. An MTT is a provisional element consisting of one or more personnel which is task organized to conduct on a temporary duty (TDY) basis a specific mission of providing direct training assistance in the form of instruction and/or technical advice to Active Army, USAR or ARNG units within CONUS. There are two types of MTT, — "point" and "area". The "point" MTT is dispatched to a single unit at a given location. The "area" MTT provides instruction at a given location to a multitude of units from a relatively large geographic area.

The Engineer School does dispatch MTT, however, they are viewed as a last resort after all other feasible alternative sources for securing the required training have been exhausted. Since the School's first MTT was dispatched in November 1972, the Engineer School and the Defense Mapping School have sent over 90 MTT to more than 20 units throughout CONUS.

Second is the Special POI Course (SPC). It consists of two-day, weekend courses of instruction offered to meet training demands which cannot be accommodated by "White Book" courses. These courses are offered in a series of four each quarter. They are designed to teach-the-teacher how to teach a specific subject. Quotas are limited to no more than two personnel per company size unit. Course capacities vary depending upon subject and are specified in the course announcement letters which are periodically sent to the field.

Students attend the SPC in paid-training status. Funding for student pay and travel is the responsibility of the orders-issuing authority. These courses are suited for MTT configuration and have been taught via MTT at unit locations. Each series has been oversubscribed. These courses have been extremely well-received by the Reserve components. The three series to date have attracted more than 400 personnel from more than 50 units throughout CONUS. Interest has been high and feedback excellent. Reserve component commanders have expressed both a high degree of satisfaction with this program and a firm hope for its continuation.

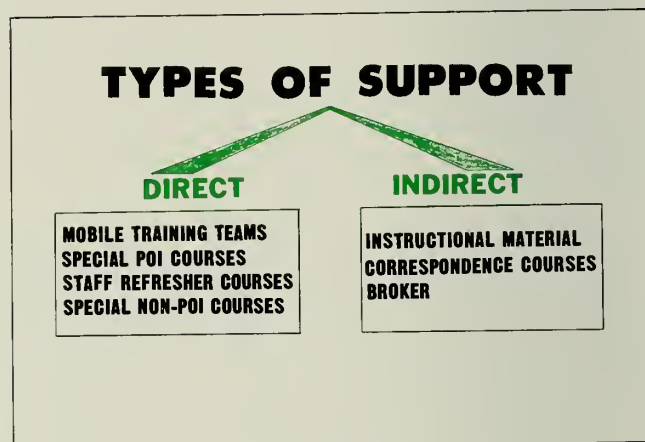


Figure 5. Types of Support

Third is the Staff Refresher Course (SRC). This is normally a 40-hour course of instruction presented on request to one or more Engineer Groups, Brigades or Commands and the staffs of their subordinate units, and tailored to provide both officer and senior NCO members of engineer staffs both refresher training and applicatory exercises. Students normally attend the SRC in paid-training status. Funding for student pay and travel is the responsibility of the orders-issuing authority.

Finally, there is the Special Non-POI Course (SNC). The SNC is a 16-hour course of instruction, normally conducted on weekends, which is presented on a request basis and is organized to meet specific training requirements of a unit or group of like type units. Units normally attend in IDT status. Since the initiation of the unit oriented SRC and SNC, over 20 units have attended 36 such courses.

The range of the Engineer School's capability for providing direct training assistance is shown on the map at Figure 6. This figure indicates the location by states of units which have received direct training assistance from the Engineer and the Defense Mapping Schools. In a given year the Engineer School and the Mapping School pass

between 5,000-6,000 students through their classrooms. Under the auspices of the Expanded Reserve Component Support Program the two schools have been touching over half again as many Reserve component students (approximately 3,300) annually through their direct training assistance activities.

Beginning in fiscal year 1976 several new initiatives will be added to the existing array of activities. Among these are the Engineer Staff Orientation Course. This course will have two formats, — one for combat engineer and one for construction engineer unit staffs. The course is designed to orient staffs of units which have been reorganized from another branch to engineer branch. Additionally, a Commanders' Seminar Course will be offered twice annually. This course will be a two or three day course for battalion and higher level unit commanders and their training officers. Its objectives will be to review training developments, share training lessons learned and develop recommendations for improving training.

To manage the School's Expanded Reserve Component Support Program, the Field Support Division has been established in the Department of Army Wide Training Support. This office is the single point of contact for all matters pertaining to Engineer School support of Reserve Component training. It is essentially a clearinghouse for coordination and information. The resident instructional departments do almost all of the instruction, both in residence and in MTT configuration. This involves the entire School in working with Reserve component units and, in addition to giving the units professional instruction, has a secondary benefit of major significance. It serves as a vehicle for reeducating Active Army engineers vis-a-vis the Reserve components and their capabilities.

Relatively few members of the Active Army have had any association with the Reserve components. Yet nearly everyone has attitudes and opinions about the Reserve components. For the most part these attitudes and opinions have been formed from second and third generation hearsay, are frequently unhealthy and have no basis in fact. The associations between the Engineer School and the members and units of the Reserve components have been eminently successful in dispelling false notions and in establishing a bond of mutual respect and appreciation for the dedication and expertise of each component — Active and Reserve — for the other.

Much has been done; yet, much remains. Engineer School support to the Reserve components is currently on a more coordinated, systematized basis as ever before. But the entire engineer training community is just beginning to



Figure 6. Engineer School - Defense Mapping School Direct Training Assistance

cooperate on constructing mutually supportive programs to the benefit of all the Army's engineers. The Engineer School and the Defense Mapping School have developed an excellent cooperative arrangement for extending training assistance to the Reserve components, including provisions for joint Engineer School-Mapping School MTT and special resident courses. The US Army Training Center-Engineer at Fort Leonard Wood also is offering a large measure of training assistance. Additionally the Engineer Coordinators at the Army Readiness Regions and the Engineer Assistance Teams at the Army Readiness Groups are participating heavily with the engineer training community in constructing viable assistance packages.

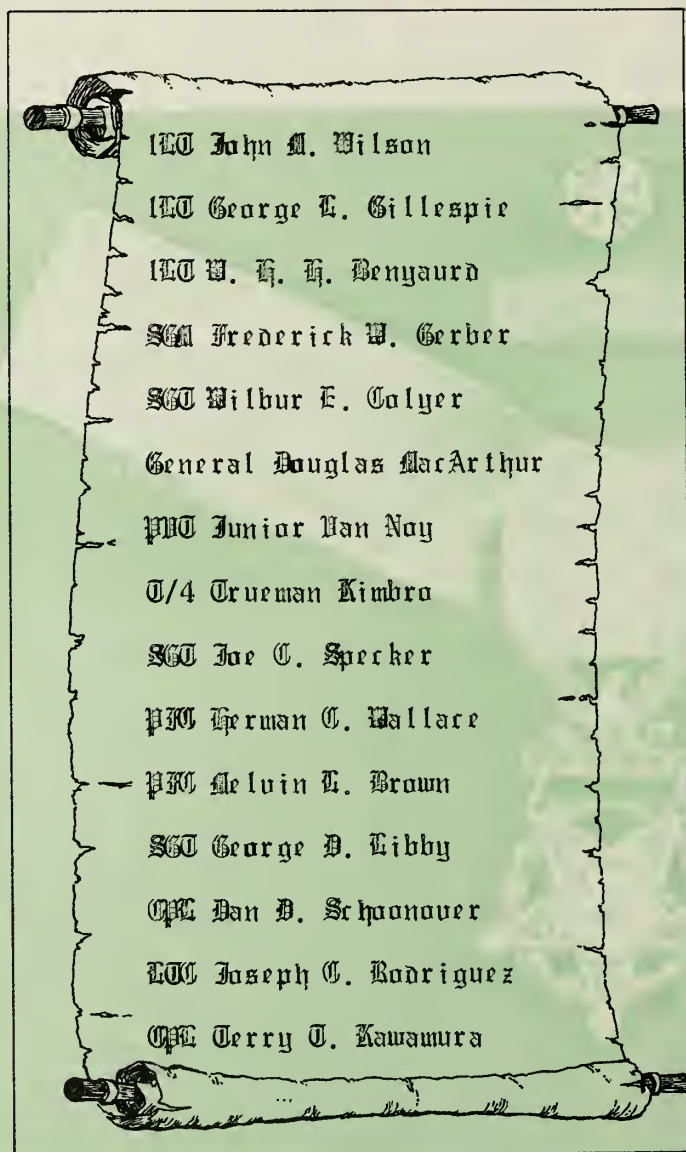
The Engineer School is the "professional home" of the Army's engineers. Reserve component engineer units should consider the School as one of their training resources just as they should consider the ARR and ARG as one of their training assets. All engineers are interested in improved readiness. The only difference is that the Engineer School spells readiness with a "T" for training. For it is only through training that readiness will come. All of the Army's engineers must work together to give the Total Army Force a corps of professional military engineers, — that is the single, common reason for existence.

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A STAR



FOR VALOR



A STAR FOR VALOR is the first of six articles THE ENGINEER intends to run on the Medal of Honor, its origin, its history, its meaning, and some vignettes about engineers who won it in the conflicts in which this nation has been engaged, beginning with the Civil War more than a century ago.

A famous American author once said, "Show me a hero and I will write you a tragedy." He spoke more truth than fiction. Many of the officers and men who have earned the Medal in the wars this country has fought, have paid the supreme sacrifice for it — their lives. Since World War I, the Medal has been awarded only for the highest acts of gallantry.

There is an old saying in the military that when the going gets tough, the tough get going. That would be the only way any member of our Armed Forces could earn the Medal of Honor — going above and beyond the call and going it tough.

So, it is only fitting that our Army engineers get an insight into the heroic exploits of some of their famous counterparts. These articles unfold Engineer history in combat from the Civil War to the present. The first article deals with the history of the Medal and what it is all about. Subsequent articles include engineers in the Civil War, the Banana Wars and World War I, World War II, Korea, and Vietnam — The editor.

Eugene V. McAndrews

Shortly after the end of hostilities in World War II, the 33d President of the United States, Harry S. Truman (1945-1953) decorated 28 heroes with our nation's highest combat award — the Medal of Honor.

As a Marine aide read the citation of a young hero who had lost both arms while saving several wounded comrades during the bloody battle for Iwo Jima, Truman broke from his attentive position and walked to the lad. Placing his hands on the Marine's shoulders, and visibly upset, he said, "Son, I would rather have the right to wear the Medal of Honor than be President of the United States."

It was a spontaneous remark that would later gain a niche in famous quotations and would be repeated by President Dwight D. Eisenhower and Lyndon B. Johnson.

Although spontaneous on Truman's part, he meant it. In 1948 he ordered the Army Information Center to compile all necessary records and information in order to prepare an official history of the Medal and the deeds of its recipients. In 1950, Truman requested the Navy to do likewise. Truman's high regard for the Medal of Honor has been shared by nearly all Americans.

The Medal was created more than 100 years ago, a product of this country's bloody Civil War. Up until that time, Americans awarded no badges of distinction to its soldiers. George Washington had instituted the Order of the Purple Heart during the Revolution; but few were awarded and the decoration was discarded until 1932. Many Americans in the 1860's opposed medal awards because they felt such awards imitated European militarism.

President Abraham Lincoln and Iowa Senator James Grimes disagreed. Grimes introduced the bill resulting in the creation of the Navy Medal of Honor. Lincoln signed the bill on December 21, 1861, approving the award of a Medal of Honor for "gallantry in action and other seaman-like qualities during the present war." On July 12, 1862, Lincoln signed a similar bill for an Army Medal of Honor "to such non-commissioned officers and privates as shall most distinguish themselves by their gallantry in action and other soldier-like qualities during the present insurrection." On March 3, 1863, the Army regulations were amended to

include officers.

Too many Medals were awarded during the Civil War. Nearly 2,100 Medals were awarded; many for genuine bravery; many more for "seaman-like" and "soldier-like" qualities, neither of which was defined. In addition, the design of the Medal proved too popular. Following the war, numerous veterans organizations, including the Grand Army of the Republic, designed badges which were likenesses of the Medal. Secretary of War Edwin Stanton nearly ruined the value of the Medal by awarding it to the entire 27th Maine Regiment — 864 Medals. Stanton also had promised award of the Medal to 12 other regiments. Fortunately he never got around to doing it.

The first elevation of the Medal to its hallowed position came a month after the Custer Massacre by Sioux and Cheyenne Indians in the Little Big Horn country of Montana. As a result of heavy fighting, company commanders recommended hundreds of troopers for Medals of Honor. But General Alfred Terry, commandant of the 7th Cavalry, stopped the recommendations. He announced that the Medal was for combat gallantry, and was not to be awarded wholesale.

Teddy Roosevelt and the Spanish American War insured further protection. On September 3, 1898, the Army Medal of Honor law was amended to read: "Medals of Honor will not be awarded to officers and enlisted men except for distinguished bravery or conspicuous gallantry . . . above his comrades, and that involves risk of life."

Roosevelt, who was recommended for the Medal but did not get it for his charge up San Juan Hill, put the Presidential Office to work in protecting the Medal. First, he had the design changed and the patent given to the Secretary of War so the design could not be duplicated. He further stated that the recipient would receive the Medal from the President when at all possible. Previous awards had been made by parcel post, and in rare cases, registered mail. Then in 1907 the first Medal of Honor roll was created.

Prompted by Roosevelt's initiative, Congress went to work on strengthening criteria for winning the Medal. In 1916, a special panel of generals reviewed all past awards to determine whether such actions actually merited the Medal of Honor. Nearly 920 names were stricken from the Medal of Honor roll, including the members of the 27th Maine, the bodyguards who accompanied Lincoln's body back to Illinois, Mary Walker — an Army contract doctor who was the sole woman ever to receive the award, and civilian scouts such as William "Buffalo Bill" Cody.

The Army also redefined valor. Required now was an act of valor against an enemy of the United

States with risk of life above and beyond the call of duty. To make sure there were no mistakes as to the position and status of the Medal, the Congress established the "Pyramid of Honor," placing the Medal of Honor as the highest of a number of other medals given for lesser degrees of valor. Instituted in 1918 were the Distinguished Service Cross (DSC), Distinguished Service Medal (DSM), and the Silver Star. In later years came the Navy Cross, the Air Force Cross, the Bronze Star, Air Medal, and Purple Heart.

Since 1916, only the highest heroism has resulted in the award of the Medal of Honor. And since 1916, the majority of Medal of Honor awards have been posthumous.

The latest conflict that involved U. S. troops was Vietnam. A total of 209 Medals of Honor were awarded for gallantry and valor in that country. The first to win it in Vietnam was a Special Forces officer, Captain Roger Donlon.

Since its establishment in 1861, a total of 3,178 members of the Armed Forces have earned the Medal. There were 431 recipients of the Medal in World War II and 131 in the Korean War.

There has been heartache in getting the medal. In 1952, Halsey McGovern refused to accept the posthumous Medal awarded to his son, First Lieutenant Robert McGovern. The older McGovern said he didn't believe politicians (President Truman) were qualified to make such awards. He also refused a Silver Star awarded to another son. Eugene Guild of Denver, Colorado asked President Truman in 1951, if his criticism of Truman's administration had prevented his son from winning the Medal.

So, what of some of the men who have won the Medal and the deeds they performed?

The first incident for which a Medal of Honor was subsequently awarded went to Army Doctor Bernard J. Irwin. He led a rescue party to the relief of an Army patrol in Apache territory in 1859, three years before the Medal was created. He did not receive the Medal, however, until January 21, 1894, nearly 33 years later.

The first Medal of Honor incident in the Civil War occurred on May 24, 1861. Private Francis E. Brownell was given the Medal for killing the murderer of Colonel Elmer Ellsworth, commandant of the New York Zoaves. Brownell received the award in 1877.

The first persons actually to receive their medals were the now-famous "Andrews' Raiders," who attempted to hi-jack a Confederate train in April of 1862. Oddly enough, in the 1880s and 1890, two of the Raiders, Alf Wilson and Andrew Pittenger, wrote accounts of the raid with each accusing the other of spying for the Confederates.

Teddy Roosevelt was recommended for the

Medal of Honor, but the recommendation was denied. Roosevelt was angered and brought strong pressure against Secretary of War Nelson Alger to receive the award. Roosevelt wrote to Senator Henry Cabot Lodge, "If I don't receive the award, no one does." Both Lodge and William Taft tried to get Roosevelt the Medal. They failed; but Roosevelt had Alger ousted from office one month later. As President, Roosevelt helped institute changes which protected the Medal.

The designs of the Medals of the three branches of the Service — Army, Navy, and Air Force — are very different. The fact that they have separate designs tends to confuse people. This has brought the military under fire. The National Commission of Fine Arts recently criticized the separate designs as "lacking the simplicity characteristic of medals of other nations." Roosevelt's son, Army Brigadier General Theodore Roosevelt, Jr., was awarded the Medal of Honor for his valor as Assistant Division Commander of the 4th Division on D-Day at Normandy. He was later killed in action there.

Captain-of-the-Maintop John Williams was the first sailor to receive the Medal. He won it for valor during small amphibious assaults undertaken to clear the James River of Confederate shore batteries during June, 1861. The first Marine recipient was Corporal John Mackie for action on May 15, 1862.

The only Coast Guardsman to receive the Medal was Signalman First Class Douglas Munro of Cle Elm, Washington. His award came in 1942 when he tried to rescue a group of Marines with his LCVP at Guadalcanal. Munro was killed in the rescue.

The first Medal awarded to a Seabee went to Marvin G. Shields, Port Townsend, Washington, for gallantry at Dong Xoni, South Vietnam, while serving at a Special Forces camp.

Five Army men have received two Medals of Honor: Frank D. Baldwin, Thomas Custer, Henry Hogan, Patrick Leonard and William Wilson. Thomas Custer wore both his medals, much to the chagrin of his brother George. More than once George told Tom to take off his "toys." Yet Tom was loyal to his brother; and he died with him at the Little Big Horn in 1876. It was legend for many years that the Sioux warrior Rain-in-the-Face had eaten Tom Custer's heart. The story was proved to be untrue.

Seven Navy men have received two Medals: John Cooper, John King, John McCloy, Patrick Mullen, Robert Sweeney, Albert Weisbogel and Louis Williams.

Two Marines, Smedley Butler and Dan Daly, received two Medals. Butler refused to wear his second medal, insisting he didn't deserve it. Con-

fronted with a charge of being "out of uniform" he decided to wear it. Daly was recommended for an unprecedented third Medal of Honor for heroism during the Battle for Belleau Woods in World War I. He did not get it but received the Army's Distinguished Service Cross — that service's second highest combat decoration.

Lieutenant Frank Luke, the "Arizona Balloon Buster," was the first flyer to receive the Medal. His World War I exploits became legends; Luke Air Force Base in Arizona is named for him. Navy Commander Howard Gilmore was the first submariner to win the Medal, his exploits coming early in World War II.

Five Marines during World War I received both the Army and Navy Medal of Honor. All served with the Army's 2d Infantry Division and were thus honored with the medals of both services. The Marines were John Kelly, Mate Kocak, John Pruitt, Ernest Janson and Louis Cukela.

Corporal Antoine Gaujot received an Army Medal of Honor for valor during the Philippine Insurrection in 1899. His brother, Captain Julien Gaujot, received an Army Medal in the 1911 Mexican campaign.

Harry and Willard Miller, brothers, received Navy Medals of Honor for similar deeds, on the same date, May 11, 1898, while on board the *U.S.S. Nashville* during the Spanish American War.

The only father and son to receive the Medal were Major General Arthur MacArthur, for valor during the Civil War; and General of the Army Douglas MacArthur, for valor in the Philippines in the early, dark days of World War II. Douglas MacArthur was the highest ranking officer to wear the Medal.

The Reverend Joseph T. O'Callahan, S.J., was the only chaplain to receive the Medal. His award was the result of actions that helped save the carrier *U.S.S. Franklin* after it had received several hits by Japanese suicide planes in April, 1945.

Despite the extensive use of helicopters in the Vietnamese war, the only "chopper" pilot to win the Medal did it during the Korean War. Navy Lieutenant John Koelsch, attached to the *U.S.S. Princeton*, won it while attempting to rescue a downed Marine pilot. He was shot down and later killed in a prisoner-of-war camp.

Two Negroes earned the Medal of Honor in Vietnam: Private Milton Olive, III and Specialist Six Lawrence Joel. A total of 45 Negroes have won the Medal.

Many American Indians also have won the Medal. The latest was Corporal Mitchell Red Cloud, a Winnepago Indian. The "Chief" was killed in Korea.

Desmond Doss, a conscientious objector, won the award serving as a medic with the Army during the Okinawa campaign. He saved nearly 75 wounded men of the 77th Infantry Division. Sergeant Alvin York, the famed hero of World War I, also was a conscientious objector before he performed deeds that brought him the Medal of Honor.

The unjustly-treated Japanese Americans of World War II have distinguished themselves. Private First Class Sadao Munemori smothered a grenade, saving the lives of several comrades during the Italian campaign. In Korea, Corporal Hiroshi Miyamura won the Medal on the Imjin River. Although later captured, he killed 60 enemy soldiers before they overwhelmed him. His award was top secret until after his repatriation. It was felt that any public announcement would subject him to intensified pressure from his Communist captors.

The publicity involved in acts of heroism has resulted in many mistaken stories of fact. Neither Colin Kelly, the B-17 hero of the early Philippines fighting, nor Ira Hays, the Pima Indian who helped raise the flag on Iwo Jima and was captured in the immortal photograph by Joe Rosenthal, received Medals of Honor. Kelly was awarded the Distinguished Service Cross. Hays never received any combat decoration. Many believe he felt so ashamed of this fact after the country treated him as a "hero," that he turned to drinking and died in a drainage ditch.

The stories of Medal winners are legend. They somehow constitute a framework for American determination.

Audie Murphy, Medal of Honor winner in World War II and hero turned movie star, who later died in a peacetime airplane crash, summed it all up best: "You never know how far a man will cast his shadow until he stands up!"

Eugene V. McAndrews is an authoritative source on the history of the Medal of Honor. A former historian in the Office of the Chief of Engineers in Baltimore, he considers his collection of historical material, diaries and memorabilia of U. S. Army winners of the Medal among the most complete in existence. He holds a B.A. in history from Carroll College, Helena, Montana; an M.A. from the University of Oregon in Eugene, and is presently preparing a Ph.D dissertation for Kansas State University at Manhattan. THE ENGINEER is grateful to have the opportunity to use his works. Some of the articles in this series were completed under the most despairing conditions. Mr. McAndrews wrote them after suffering a stroke that paralyzed one side of his body and suffering kidney failure.



CAN YOUR UNIT MEET ATP STANDARDS

Captain Thomas F. Ramos

When the United States Army adopted a system of decentralized training, it placed a tremendous amount of responsibility into the hands of company commanders. More than ever before, a company's ability to perform as a well trained unit is dependent upon the zeal and management ability of its commander.

There is a large assortment of Army literature available that is useful for unit training, but most important are the Army Training Programs (ATP).

The new ATP's presently being published are essential to company commanders in conducting unit training, for without them, there would be no specified guidance on the degree of readiness expected of a unit.

Army Training Programs are developed from a study of a unit's capabilities, as stated in its Table of Organization and Equipment (TO&E). These unit capabilities provide a list of missions that are appropriate for the unit to perform. Skills needed to accomplish these missions are then listed in the ATP.

Defined in its simplest form, an ATP lists specific tasks that may be given to a unit, and the minimum standards which should be met for each task. For example, an ATP for a combat engineer company may have a task of building an eighty foot, double single, Bailey Bridge with an objective of completing it within three hours. If, under normal conditions, the company cannot complete the bridge within three hours, then that company is not considered combat ready.

Herein lies the importance of an ATP, for it acts as a gauge, and without it the commander cannot compare his company's performance with accepted Army standards. Army Training Tests, which determine whether a unit is combat ready, are based entirely on the standards established in the ATP's.

A fictional situation using ATP 5-35 (Engineer Combat Battalion, Army or Corps), will illustrate some ways of efficiently utilizing the ATP to manage a company's training program. A newly arrived officer has just taken command of a Combat Engineer Company.

By studying the results of the company's last ATT and interviewing his platoon leaders and platoon sergeants, the new company commander determined those mission areas in the ATP his company is weakest in performing. He set priorities in his training program in river crossing operations, defensive barriers and combat construction.

Training based on the ATP requires an efficient use of time, so the commander, after coordinating with various post facilities, limited dental, finance and other non-emergency appointments to Thursday or Friday afternoons.

Routine activities, such as motor stables, physical training, and weekly command information classes were scheduled only in the afternoons, to allow as much time as possible for training in the mornings. In addition, the commander limited his administrative work, Article 15 hearings, and inspections to the afternoons so he could be present to observe his unit training.

The commander notified his platoon leaders and platoon sergeants of specific tasks in the ATP they were to prepare for instruction at least three weeks in advance, so they could prepare lesson plans for his inspection and approval.

ATP 5-35 emphasizes squad training as the key to good company performance. If each squad in the company could properly install a deadman, erect an anchorage tower, and attach a cable to a tower and deadman, then each of his platoons, without any further training, could completely install an anchorage system for a floating bridge.

None of the tasks need to be learned next to a river; so weeks before the company was scheduled to go to a special training site for float bridge training, the company trained its squads in the basic skills of bridging. Having saved some time, the commander concentrated his training at the bridge site on the more difficult skills which must be learned on the river. At the same time the squads were training with bridge equipment, company truck drivers trained in vehicle camouflage and truck recovery techniques.

Since a large portion of the ATP's combat con-

struction tasks involves operator skills, the company commander kept his earth moving equipment operators as busy as possible. He had them construct roughly graded roads through the post demolition range and then used the roads to train his squads in road cratering. When possible, he used his dozers, front loaders and dump trucks for community relations' projects. At the bridge site, his operators improved access roads and bridge assembly sites. Throughout this period the operators' section leader supervised their activities, striving to train them to meet the performance standards in the ATP.

To generate interest in the training and to train in other areas of the ATP, the company commander sent his three line platoons to the bridge site by different routes. One platoon arrived 15 miles upstream of the site and infiltrated in on assault boats. The second platoon conducted a tactical march to the bridge site and defended it against the third platoon which conducted an airmobile assault on the bridge site.

In order to ensure the success of his training program, the commander continually evaluated his squads. Each squad had to pass proficiency tests every Friday morning that covered the tasks taught during the week. A squad failing to meet the ATP standards had to take a retest on Saturday and train each subsequent weekend until it met the standards. The company continued to train in large sized tasks, such as Bailey Bridge construction, until it could attain the ATP standards.

As can be seen here, unit training is a full time job which requires a great deal of effort from the unit commander. Unless a majority of his time is spent on training management, the unit's training program will be a failure. The unit will lack the ability to react quickly to an emergency situation, and will undoubtedly lose lives from being poorly trained.

The Army Training Program does not dictate to a commander how he should train his unit. However, it does tell the commander, in a fully comprehensive way, when his unit is trained well enough to make it combat ready.

Captain Thomas F. Ramos is a graduate of the United States Military Academy at West Point. After receiving his commission in the Corps of Engineers, the captain was assigned to the Department of Doctrine and Training Development at the U. S. Army Engineer School as project officer for the preparation of ATP 5-35, Combat Engineer Battalion, Corps. He is a recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia.



MANEUVER DAMAGE CONTROL

Captain Richard G. Perreault

Today, during a period of inflation, increased costs and limited allocations, the Army must closely control its operational resources. For years, many people have looked upon damage done during field training exercises as unavoidable and the costs incurred as a trade off for the needed training. If the Army can control and minimize maneuver damage, when operating off military reservations, as in Europe, the overall costs will be minimized.

The mission of controlling and repairing maneuver damage logically falls to the Corps of Engineers who have the background, experience and assets to help combat this problem. The Division and Brigade are the principal maneuver elements and since they have organic engineers, this is the logical level to minimize maneuver damage.

The cost of maneuver damage claims cannot be overemphasized. The United States share for maneuver damage payments for Reforger II (September-November 1971) was over \$1,435,000. The costs for Reforger IV (January-March 1973) has already exceeded \$525,000 and all claims are not yet settled. Even a division-sized maneuver such as Marne Rock I (May 7-12, 1971) cost

approximately \$175,000. Some maneuvers in Germany, have been cancelled or postponed because of the anticipated maneuver damage.

Payments for damaged forests are according to the type of tree, age of tree, value of the wood and the labor costs to replace and restore the forests. Naturally, the claims must be investigated individually and claims personnel must be very diplomatic and knowledgeable when computing the final amount of the claims.

The Claims system and the methods of computing the amount actually paid is very complex. For example, road damage is paid for on an area basis, structural damage by replacement or restoration costs and perhaps the most complicated damage payments are for damage to farmland and forests. A ruined field of wheat would not only be the marketable worth of the grain, but also the farmer's labor costs, and the cost for recultivating the field.

Claimants don't always receive the amount of their original claims. For example, only 36 percent of the amount claimed in 5,644 claims for Reforger III was actually paid. The Army and its Engineers can't be expected to stop all maneuver damage,



but they can greatly minimize it.

An effective Maneuver Damage Control Program can be implemented in three phases: planning and training before the maneuver, control and repairs during the maneuver, and reporting and investigating both during and after the exercise. All three are equally important if the program is to be effective. A well trained and controlled force not only minimizes maneuver damage, but it also reduces inconveniences to the inhabitants in the maneuver area. Let us examine each.

PLANNING AND TRAINING PHASE — This is the responsibility of the Divisional Engineer Battalion. At battalion level, a Maneuver Damage Control Officer should be appointed to organize and lead the battalion Maneuver Damage Control Headquarters and formulate the overall Division policy.

Supporting engineer company commanders would be responsible to give maneuver damage control classes to the supported maneuver Brigades' elements.

Liaison and coordination must be made with all of the participating Division elements, the Information Office and public officials from the maneuver area. Unless conditions prohibit, the

population should be notified well in advance of the exercise through the Information Office and explained the procedures for submitting claims of damage to private property.

The Maneuver Damage Control Officer should delineate and publish restrictions in the maneuver area. These should be furnished to the lowest command levels of the maneuver elements for planning purposes. He should also publish a list of procedures to minimize maneuver damage.

Each maneuver element from the company sized unit to the Division must have comprehensive maneuver damage policies and operating procedures. Maneuver damage officers must be appointed at each level to consolidate and regulate the control effort.

All personnel, to include subordinate leaders and vehicle crews must learn how to minimize maneuver damage.

Commanders must be familiar with the procedures, organization and functions of the Maneuver Damage Control Headquarters and must plan around any restrictions in the maneuver area.

CONTROL AND REPAIRS DURING THE MANEUVERS — These are the Maneuver Damage Control Headquarters' Responsibilities.

The Maneuver Damage Control Officer will



keep the maneuver commander aware of trafficability conditions, engineer efforts and keep a log of all reported maneuver damage.

Mobil maneuver damage survey teams will travel the maneuver area, make spot reports of investigated damage and keep the Maneuver Damage Control Officer aware of maneuver conditions.

Engineer personnel and equipment must be available to make hasty, on the spot, repairs when a safety hazard exists.

Commanders must insure that unnecessary maneuver damage is avoided.

Spot Reports must be sent to the Maneuver Damage Control Officer in a timely manner.

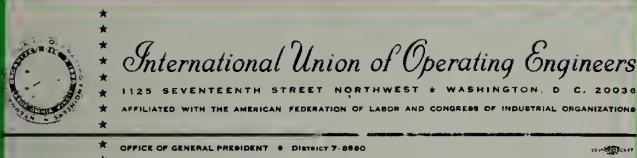
Hazardous or unsafe conditions must be rectified immediately, if possible, and reported.

AFTER MANEUVER REPORTING — This is the responsibility of the Maneuver Damage Control Officer. He will consolidate all Brigade and Engineer reports, make an overlay showing damaged areas and forward copies to the Division Claims Office and any other Army Agency handling claims for the area. He also will brief and advise the commander of the overall maneuver damage situation; and investigate any newly reported damage and periodically update maneuver damage assessments.

Appointed maneuver damage control officers must make and consolidate the reports at the company, battalion and brigade levels and submit them to the Maneuver Damage Control Officer. Then commanders should debrief their personnel and take corrective actions deemed necessary.

Maneuver Damage in most instances can be avoided. Commanders using available assets, comprehensive programs and policies and command emphasis can greatly reduce the costs of training their units during realistic exercises. However, every subordinate leader, vehicle driver and squad member must be aware of and have a willingness to minimize maneuver damage for the effort to be successful.

Captain Richard G. Perreault is assigned to the Far East District, Pacific Division. He is a graduate of Worcester Polytechnic Institute with a Bachelor of Science Degree in Civil Engineering and the Engineer Officer Advanced Course. Prior to coming on active duty he worked for the California Division of Highways. During the four years he was stationed in Germany, Captain Perreault served as a platoon leader, Battalion S2, and Company Commander in the 10th Engineer Battalion, 3d Infantry Division. While detailed at the S2, he also served as the Division Maneuver Damage Control Coordination Officer.



January 8, 1974

TO: All Local Unions of the IOOE and
Operating Engineers in uniform

The extension of formal apprenticeship to the Armed Forces of the United States is a milestone in the development of progressive manpower policies within the Department of Defense.

The International Union of Operating Engineers is deeply committed to the development of skilled journeymen for the construction industry. A fully qualified journeyman is an asset to his employer and need ask favor of no one.

For these reasons, it is a pleasure for our organization to serve on the National Joint Apprenticeship and Training Committee for Military Equipment Operators and Mechanics.

Local unions and their representatives on our Joint Apprenticeship Committees should extend appropriate recognition to participants in this program when veterans enter the civilian labor market.

Sincerely yours,

Hunter P. Wharton
Hunter P. Wharton
General President

aml
opeiu#2

Major Hugh T. Stevenson

APPRENTICE TO JOURNEYMAN

Can you qualify in the civilian community as a journeyman? If you are currently pursuing an Equipment Operator or Engineer Mechanic MOS (62 series), a nationally recognized military journeyman may soon be a reality and a first for the U.S. Army. If this initial program is successful, all marketable skills within the Army may, one day, be tied to an industry related apprenticeship program.

Apprenticeship programs are not new. In 1937, the U.S. Department of Labor developed training guidelines for training skilled tradesmen for our nation's work force. These guidelines were general in nature and applied to apprenticeable occupations. Selling, clerical, professional (doctors) and agricultural occupations have traditionally not used apprentices.

The Department of Labor spelled out to industry what a good apprentice program should include. Here are a few of the key points:

- Non-discrimination practices in all phases of the program: i.e., selection, retention, promotion.

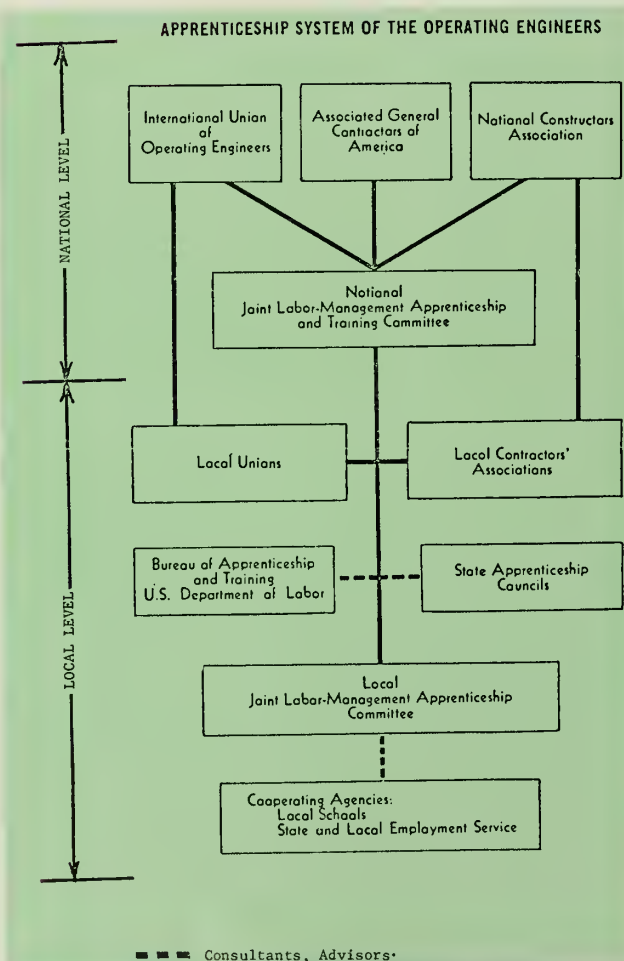
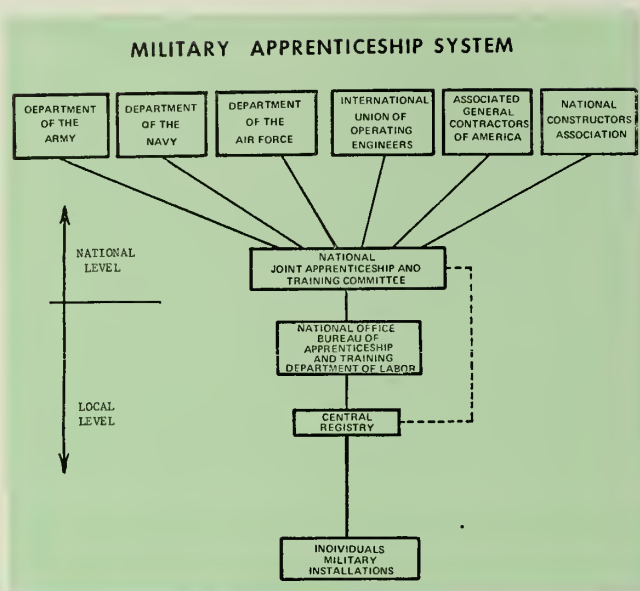
The Army has locked in on this one. It is an equal opportunity employer.

- A schedule of training and experience required of the trade. The minimum time is two years for any program. Some trades take as long as six years but the majority are three to four years long. It does take time to produce a highly skilled journeyman. If we look at our individual and unit training programs, this point is pretty well covered.

- Organized or related instruction. This provides knowledge in technical subjects to apprentices. Your AIT provides some of this instruction right now.

- Periodic evaluation of apprenticeship progress including job performance, related instruction and records. Your Apprentice Master Record or Log Book covers this section. Your MOS test and EER take care of the rest of this requirement. Details are covered in AR 350-14.

- Proper supervision of OJT with adequate facilities. The chain of command starting with



your squad leader meets this guideline. We surely have the facilities to train journeymen.

- **Labor-management cooperation.** This means Army-Industry cooperation in concurring in an apprentice program.

With few exceptions, your training equates to a civilian apprenticeship program.

What's so different from industry training as compared to the Army? For certain trades there is little difference in training journeymen in civilian life or through the Army Training System. In many cases, industry just doesn't understand our terminology, i.e., MOS, EER's, BCT, AIT. There are some Army skills where our degree of training is not as demanding as industry. This is primarily because there are no slots or positions required for such a high degree of skill. This is true in the vertical construction skills. The Army doesn't have a requirement, at present, for a Master Electrician or Mason. However, the training and experience that you pick up in the service may count, in the future, towards an apprenticeship program in industry.

How does industry train their journeymen? By complying with those Department of Labor guidelines. Industry establishes their own apprenticeship standards for each respective trade. These standards are registered with the Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training. Registration makes a public record that an apprentice is being trained under established standards for a trade or skill. Generally, no one firm makes up the standards. Normally two or more national organizations establish the standards. In the case of the Operating Engineer, three organizations developed the standards and formed a committee.

Take a look at the Apprenticeship System for Operating Engineers. Treat this system in two levels; one national and the other local. The national level establishes standards and meets the requirement for management-labor cooperation. This committee is composed of representatives from the International Union of Operating Engineers, Associated General Contractors of America, and the National Constructors Association. If standards change, the national committee does all the work. The local level or committee implements the standards.

Why have an apprenticeship program for the Army? Considerable effort has been invested by unions, contractors and governmental agencies in developing standards for trades and crafts. These standards are well developed and defined. In addition, a certain degree of ethical standards are built into such a program. When training standards and ethics are combined, everybody benefits, from the individual to the U.S. Army.

Realizing that every soldier is not going to stay in the service, a military apprenticeship program can serve as the stimulus or motivation for the non-career soldier to contribute his best to the Army while getting the most from his training and experience.

What about a system for the Army? First, let us get a little background. A great deal of effort has been placed on getting all Services to consolidate training base requirements with the goal of reducing costs. The equipment operators' field was chosen as one of the first engineer-related programs for this endeavor. In September 1973, a standard program of instruction (POI) was developed by Army, Navy, Air Force and Marine Corps representatives at Fort Belvoir. At present, the Navy is conducting a test on three cycles of training using this POI. It is planned to have the Army, Air Force and Marine Corps consolidate AIT at Fort Leonard Wood starting in early November of this year. The Navy will continue to use Port Hueneme, California as their training base but will use the Interservice POI.

Interservice training took a giant step forward for the Army. It provides for a multi-skilled operator. One MOS will cover the operation for several pieces of construction equipment. This concept helped to align our training program closer to industry or the trade of Operating Engineer. Needless to say, any effort on our standards took on an Interservice title.

Take a minute to look at the proposed Military Apprenticeship System. A noted similarity exists between the military and the industry system. There are still two levels: A national committee and a Central Registry which performs similar functions to the local committees. The Central Registry monitors all apprenticeship actions and serves as the interface between you, the apprentice, Department of Labor and the National level or Committee. If local committees were established, unit commanders would be tied up with local union and contractors in long meetings on apprenticeship actions. Since states have different laws on apprenticeship local committees would also be bound by different state laws. The Department of Labor has agreed to monitor apprenticeship actions through our Central Registry. This procedure makes it a simple matter when apprentices are assigned overseas or transfer within CONUS.

What about our standards? Just what is in our standards — Interservice Training Standards for Military Equipment Operators and Mechanics. Our program follows the registered program for the trade of Operating Engineer:

- A four year program consisting of 6,000 hours of OJT.

- A minimum of 432 hours of related instruction. Here maximum credit is given to your AIT schooling. The remaining instruction is contained in correspondence courses or formal unit instruction.

All OJT documented in your Apprentice Master Record will be credited to this program at time of implementation. The E4's and above will receive 500 hours of OJT credit without documentation or AMR. This credit is granted only if you actually have 500 hours of stick time or hands-on training.

- Forms and records are the same as found in your Apprentice Master Record. The registration or application form becomes initially the most important form.

- Completion of the program will result in a certificate from the Department of Labor.

- Industry support of the program. To get a journeyman rating in civilian life, you have to work for it. There will be no difference with the Interservice program. It takes three years on the outside to obtain this rating and at best four years while in the Army. If you leave the Service without getting a completion certificate, you will receive credit by the civilian member organizations of our National Committee towards their apprenticeship program.

What will the future hold? Our proposed program has started on its long way up to Department of Defense and Department of Labor. Other Service schools, Transportation, Ordnance, Military Police and Quartermaster are developing similar programs. The timing is right for the Army to support apprenticeship efforts. Your part in the program is to make sure you are registered and are maintaining the Apprentice Master Record, under the existing Military Engineer Apprenticeship Program. Previously identified as the Trade Union Recognition Program. This title was looked on by Department of Labor and the Associated General Contractors of America with disfavor. Despite our disclaimer in the AMR, the title implied union support. The union recognition title has been eliminated.

Our proposed program has a great deal to offer industry, the Army, and our nation's work force.

One wonders if the day will ever come when the high school graduate applies for a job and gets this reply: "Join the Army and learn a trade first."

Major Hugh T. Stevenson is assigned to the Engineer School, Deputy Commandant for Combat and Training Developments where, as a project officer, he was involved in developing the Interservice Apprenticeship Program. He is currently Chief of the MOS Test Branch, Training Programs Division.



THE MILITARY DIMENSION IN CONTAINERPORT DESIGN

The adoption of containerization techniques by the military is perhaps the greatest thing that has happened to the movement of military materiel in this century. Its presence connotes ease in handling both at port-nodal points and aboard ship; efficiencies in manpower and shipping time; and cargo security.

The economics of containerization show evidence of increased ship productivity by approximately a factor of three as a result of reduced "inport" times, while affording the ship-owner an improved return on his investment from five to eight times that achieved by conventional break-bulk cargo vessels operating along the same routes.

Not mentioned is the increased productivity for terminal service personnel and terminal resources by a factor of approximately 10 with the use of containerized cargo.

Cargo Configuration	Unit Labor Factor
Break-bulk cargo	0.52 units (*) per manhour
Containerized cargo	2.54 units per manhour
(*weight, LTONS or cube, MTONS)	

How is all of this advantage to be developed in terms of port space requirements and physical arrangement of facilities? What minimum facilities are required for a single or multiple containerport? What tonnages are required to justify the construction of a containerport? These are just a few of the questions which must be asked and answered before construction can begin.

To be part of the total transportation system in the general port area, the containerport must be linked to the road and rail network, if the latter exists. Of lesser importance, site selection should also consider accessibility to an all-weather airport. In a military setting the selection of a containerport site should exclude sites where waterside

access is limited by the presence of navigational hazards, where operations are affected by seasonal sea conditions, or where extensive dredging is required.

During the planning phase a survey should be made of maximum draft requirements for vessels expected to call at the new port. Vessel draft requirements for standard C-2 and C-4 container-ships are approximately 28 feet, while super-container-ships with a capacity for 1,400 or more equivalent 20-foot containers will have a draft of 40 feet or more. Therefore, at berth water depths must not be less than 34-36 feet for the C-2 and C-4 vessels and at least 45 feet for the newer and greater capacity container-ships.

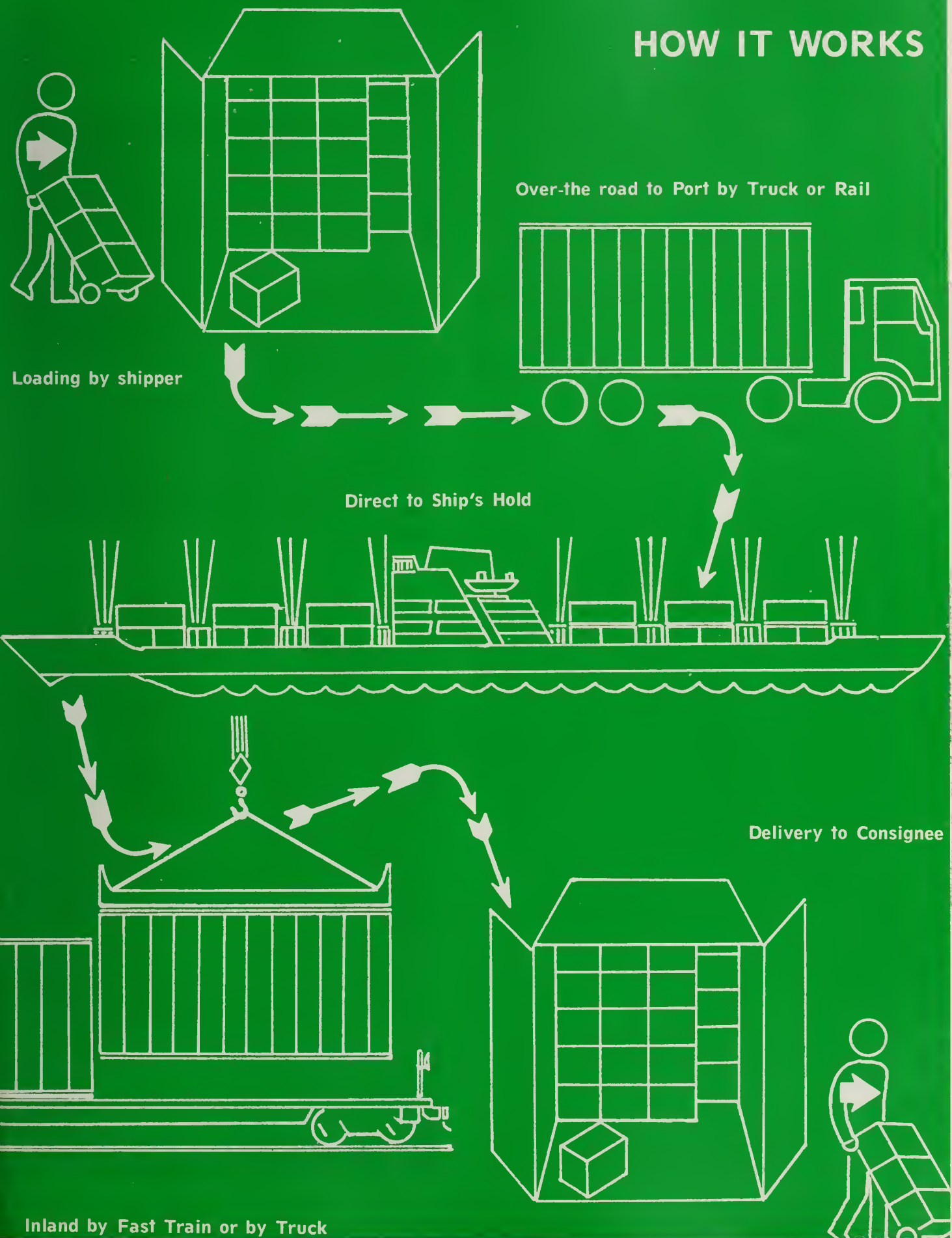
The use of Delong-type barge units can sharply reduce port construction where bottom soil conditions and tidal range permit. Equally important is the back area of flat land required for container storage, marshalling and other container related and support facilities.

Minimum facilities at the containerport for vessels without ship mounted gantry cranes are single or multiple berths of an appropriate length, gantry cranes of sufficient capacity; container marshalling area(s); container stuffing and stripping area for less-than-container load (LTCL) cargo; entry and dispatch facilities including container documentation points, container inspection and import customs; and support equipment storage and maintenance areas.

The minimum per-berth containerport area is about 25 acres; however, where land area is not restricted, a per-berth area allocation of 40 to 45 acres is recommended. As the size of containerport increases with an increased number of berths, the average area per-berth will decrease.

Minimum export and import (combined) container cargo to justify a containerport is approxi-

HOW IT WORKS



mately 350,000 STONS per year.

Containerport layout is an important factor in determining operating efficiency, security, and containership turn-around time. Equally important are the state of training and proficiency of terminal service personnel and the proper scheduling of containers to and from the port. If a containerport is properly organized and operated it can achieve an annual per-berth capacity upwards of 500,000 STONS.

The geometric shape of a containerport should be rectangular. The final dimensions are a function of land area available, number of berths and whether a pier or quay-wharf arrangement is used. Based on the land area available, a special effort should be made to minimize the average distance between the marshalling area and the shipside gantry crane.

Containerport layout is influenced greatly by the type container(s) handled. Size of container is generally carrier-oriented. For example, SEALAND SERVICE uses a 35' x 8' x 8½' container, whereas AMERICAN PRESIDENT LINES uses a 20' x 8' x 3' box. If container size is not taken into account such aspects as gantry crane spreader frames for vertical container handling, trailer chassis, and container marshalling-parking design becomes impossible.

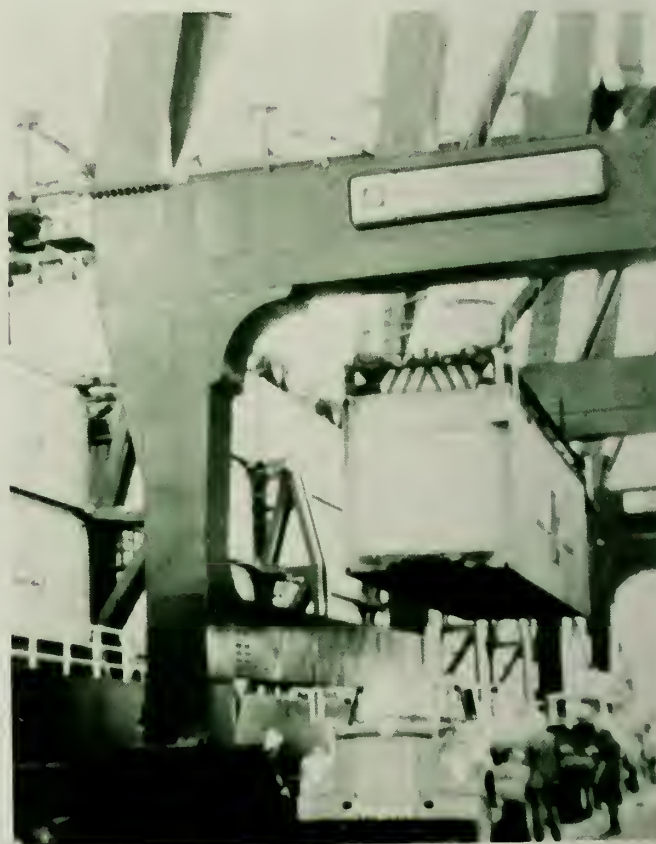
Term contracts with a single carrier or exclusive use of MILVAN containers can facilitate planning and later operations. Landside container handling may be performed with bogey-type chassis used to move containers to and from the containerport or via straddle carriers which afford the added advantage of multiple stacking of containers in the marshalling area. If the latter method is used, pavement strength must be provided which is adequate to support the additional container load and the wheel load of the loaded straddle carrier.

Access to the containerport is via an entrance complex. This is where port documentation is initiated and where the port operator assumes responsibility for export (outgoing) containers. Marshalling instructions to pre-determined parking locations are assigned at the entrance complex for each container by container number. Initial inspection is also conducted in this area. Cold-storage reefer containers are assigned to stalls equipped with electrical outlets. Ship manifests are prepared on the basis of destination and container number. Off-loaded import containers are similarly assigned to pre-determined parking locations in the marshalling area based on information received on pre-arrival ship manifests. Prior to their departure from the containerport, containers are normally inspected and passed through a customs inspection.



Container Marshalling Area

Lower Portion of Gantry Crane





SEA-LAND SERVICE container

Aerial View of Pier 4 (DeLong)



Of special concern to the port designer is the handling of export and import containerized cargo which comprise less-than-containerload shipments. To accommodate LTCL cargo, an estimate must be made of export cargo to be stuffed in outbound containers and import cargo to be stripped from inbound containers. This data is essential for the sizing and layout of receiving (export cargo) and delivery (import cargo) buildings, generally of a standard freight consolidation building design for stuffing and stripping containers, and cargo transfer to and from small cargo vehicles.

Detailed space allocation within the port becomes a function of container storage time-requirements, arrival rates of export containers, entrance complex and inspection processing rates, and out-processing times for containers departing the port. Queueing lanes at the entrance complex and in the vicinity of the receiving and delivery buildings also must be provided. One aspect of the total port complex which must not be overlooked is an area of adequate size for maintenance of bobtails (or straddle carriers), equipment storage, containerport utilities.

Experience at the Pier 4 (DeLong) complex, Cam Ranh Port, Vietnam, demonstrated that a minimum number of well-trained personnel can handle large quantities of containerized cargo with near optimal time-efficiency. During one 25-hour period more than 12,000 STONS of containerized cargo was unloaded and empty containers were reloaded aboard a SEA-LAND C-4 vessel. Turn-around times such as those substantiate the ship-owner and port-operating efficiencies. Normal container cycle times employing trained personnel, that is the time required to remove one container from the ship and load a second container on the ship, generally vary from four to six minutes.

Container related port operations demand a greater awareness of the "total transportation system" concept than other conventional methods of cargo handling and shipment. Linked with this method of cargo handling is the physical facility which becomes a function of cargo traffic pattern and related inter-modal and inter-port cargoes moved through the containerport.

If all aspects of the system can be optimized, then efficiencies can be realized by the port operator, by the carrier, and individual shippers and consignees. If all these things are accomplished — we have done our job — and the advantages of CONTAINERIZATION are ours!

Major Paul J. Theuer is a former Commandant of Cadets, Army ROTC, at Pennsylvania State University. He is a registered Professional Engineer in the District of Columbia and holds a Master of Science degree in engineering.



ENGINEERS AND ETHICS

Captain Jess J. Franco, Jr.

Should the Corps of Engineers have a Code of Ethics? Proponents of such a code have stated that as professionals it is strongly needed. Some believe that such a code would be too lengthy and cumbersome and therefore too difficult to apply. Others feel that individual standards are sufficient to guide one in the selection of his courses of action. If, however, we are to truly be professionals, should we then not have a professional Code of Ethics?

The highest compliment that can be given to a member of the military is to call him a "professional". By stating this, we are implying that he is technically proficient and military in his manner. But, is that all that is required of a professional in the military — and, in particular, in the Corps of Engineers? In civilian professions, a professional is more than a correctly performing, proficient

technician. Each profession has a set of ethical rules. Individuals are judged equally by their ethical conduct and technical proficiency. To be a professional he must meet both these standards. Therefore, should there not be a set of ethical rules — a Code of Ethics — for the military and particularly for the Corps of Engineers?

As engineers, we have an obligation to protect the safety and welfare of others. A poor design or careless construction can result in injury and/or death. Unlike many other professions, ours affects many, not a few. As a result of this responsibility, the civilian engineer profession has placed on its members requirements of competency, proficiency of performance, and the highest degree of moral and ethical conduct. To govern the conduct of the Professional Engineer, a code of ethics was adopted. This code specified guidelines for the engineer concerning the manner in which he was to practice his profession. Unlike the civilian engineer, the military engineer does not have such a code, yet he provides the same type of service.

Being members of the Corps of Engineers, we find ourselves practicing two professions. We are members of the military and we are engineers. Both professions have requirements and responsibilities which must be met. To be a professional in either, one must conform to technical and ethical standards. Regarding the latter, General Westmoreland has stated that "... the individual officer bears responsibility for the establishment and observance of scrupulous, ethical standards." This applies to both the engineer officer and the engineer NCO. To be professionals, we need a Code of Ethics. It would provide guidance in the practice of both of our professions — particularly as engineers.

Some individuals will still feel that such a code is impractical because of the complexity needed to cover our profession accurately and because the military engineer wears two hats — that of the combat and the construction engineer. The responsibilities and requirements of each is not necessarily the same, but are similar. Whether one performs in a combat or a construction role, one common denominator exists — we are still engineers. It would be truly impractical to attempt to establish a Code of Ethics which covered every area of conduct for every situation. However, a basic code, limited to major precepts, could easily be adopted. As such, it would allow sufficient lateral interpretation to be applicable to most situations. The degree of engineering may change, but the principals of conduct and the values of professionalism should never vary.

Basing a profession on individual standards of conduct tends to offer a shaky foundation upon which to build. Each individual will govern himself

according to his own standards. They may or may not agree with the majority of his profession and may or may not enhance the reputation of his profession. What may be considered acceptable or allowable to one individual may be morally abusive to another. This is not to say that a code of ethics should take away the individuality of its members, but rather that some form of unity of idea or belief is necessary to protect the honor, integrity, and professionalism of the respective vocation. Therefore, the following is offered as a basis for a Code of Ethics for the Corps of Engineers:

- *I am a professional. I will base my decisions on accuracy, sound judgement, and truthfulness. My actions will be characteristic of the highest standards of the Corps of Engineers.*

- *My profession is critical to the health, welfare, and safety of others and therefore requires that my practice be conducted with the highest degree of technical, moral, and ethical standards.*

- *I will never perform in such a manner as to impune my integrity, the integrity of others of my profession, or the reputation and honor of the Corps of Engineers.*

- *I will conduct myself, such that, my course of action is never as a result of personal gain; at the expense of others.*

- *As a member of the Corps of Engineers, I have an obligation of responsibility as an engineer and as a member of the United States military. I will conduct myself as a professional by means of proficient and ethical judgement.*

Should the Corps of Engineers have a Code of Ethics? I sincerely believe so. We are truly professionals by vocation. Such a code would produce a unity of conviction and a bond of professionalism within the Corps; respect and recognition without. As engineer officers and NCO's, we have an obligation and responsibility to meet — to be truly a profession with a Code of Ethics.

Captain Jess J. Franco, Jr., is a graduate of the Engineer Officer Candidate School, a recent graduate of the Engineer Officer Advance Course, and holds a BS degree in Civil and Environmental Engineering from the University of Wisconsin. He has served with the 39th Engineer Battalion (Cbt) in RVN, the 91st Engineer Battalion (Cbt) in CONUS, and commanded a company in the 389th Engineer Battalion (Const) in CONUS.



A POSSIBLE SOLUTION TO A DANGEROUS PROBLEM

Captain William D. Brown

Nuclear engineers and physicists at the U. S. Army Engineer Power Group at Fort Belvoir, Virginia appear to have found a solution to the problem of how to dispose of chemical warfare agent stockpiles in this country. The breakthrough also would solve future situations where the use of chemical warfare agents by an enemy may require extensive detoxification of our own military and civilian water supplies.

The news media has made the American public aware of the problem of how to dispose of chemical warfare agent stockpiles with extensive coverage of the topic. The subject was given nationally televised coverage on the CBS program "60 Minutes" last year. In addition, the Washington Post and Newsweek magazine have run in depth articles on the topic. This type of coverage obviously has aroused an increasing interest in chemical warfare agent stockpiles, especially toward those at the Rocky Mountain Arsenal, near Denver.

The presence of a significant quantity of GB, a colorless, odorless nerve gas and other toxic agents at Rocky Mountain Arsenal poses a major community relations problem and a potential safety hazard for the Army.

Although committed to relocate or otherwise dispose of this stockpile, the Army is burdened with the immediate problem of accomplishing this feat in the face of technological, environmental, and legal complications. Such disposal methods as ocean dumping are now practically and politically infeasible. Incineration methods also appear to be economically and environmentally unsound, even if the likely legal litigation could be successfully overcome.

The solution the Power Group's nuclear engineers and physicists offer draws upon extensive research in the radiochemistry field in the treatment of wastewater by ionizing gamma radiation. The gamma radiation molecularly dissociates hydrocarbon compounds, as found in sewage water, and may similarly be used to destroy the organic hydrocarbon compounds which compose the basis of chemical warfare agents.

Although no specific research has been done on gamma ray destruction of such agents as GB, VX, and BZ, a similar process, reverse osmosis, has been examined by scientists at the Edgewood Arsenal in Maryland. It was determined there that this process was capable of removing significant amounts of toxic agents in water in all circumstances. However, improved equipment and techniques are expected to produce water with



less than the maximum permissible concentrations (MPC) of such agents as BG and VX.

The Engineer Power group has recommended a program designed to determine if gamma radiation is effective in destroying toxic agents and to establish dosage requirements for the detoxification operation.

If the gamma irradiation technique is found to be efficacious and economically feasible, a portable irradiation unit can then be used to detoxify the chemical agents at their storage locations. The rig could be used against chemicals in steel containment or against batch quantities of the agents. As there would be no residual radiation, the detoxified materials and containers could then be disposed of by routine methods. This approach also may aid the Department of Agriculture in disposing of excess pesticides for which it is now responsible.

Radiochemical treatment of toxic agents and pesticides has a number of potential advantages:

- It would involve no legal conflicts with federal, state, or local regulations.
- It would require no environmental impact statement.
- Air and water pollution would be minimal.

- Agents can be neutralized in canister or volume quantities.

- Military manpower can be used for the entire operation, facilitating control and security.

- Transportation of agents would be avoided with the use of the portable rig.

The ultimate feasibility of this method of detoxification will be determined by the Corps of Engineers in conjunction with the Surgeon General's Office and the Chemical Corps. Its initiation at the Engineer Power Group represents one more way in which advanced technology can be applied by the Corps of Engineers to meet the challenges of guaranteeing a safe and healthy environment for our nation.

Captain William D. Brown is assigned to the Division of Science and Technology, Defense Nuclear Agency in Alexandria, Virginia. He has served with engineer construction units in Germany and Vietnam and most recently has completed the Engineer Officer Advanced Course. He holds a B.S. degree from the United States Military Academy and M.S. and N.E. degrees from the Massachusetts Institute of Technology. The captain won the Henry Larcom Abbot Award for excellence in writing during the EOAC based on his presentation of "A POSSIBLE SOLUTION TO A DANGEROUS PROBLEM."

BRIDGING

MANY EM ARE ELIGIBLE TO ATTEND NCOES

MEMBERS OF THE ACTIVE ARMY or of a Reserve Component in the grade of E4 with less than eight years service or E5 with less than 12 years service who have demonstrated leadership potential for noncommissioned officer positions are eligible to attend the Engineer NCOES Basic Course (ENCOB) provided they are qualified in one of the listed prerequisite MOS's, have an MOS test score of 100 or more, and 11 months or more of active duty service remaining upon completion of the course. No security clearance is required (except 12E). These are the prerequisite MOS's for ENCOB:

12B	41B	51F	51N	52E	62D	62K	81D	83D
12C	41K	51G	51Q	53B	62E	62L	81E	83E
12D	51B	51J	51R	53C	62F	62M	81F	83F
12E	51C	51K	52B	57D	62G	81A	82B	
12F	51D	51L	52C	62B	62H	81B	82D	
35E	51E	51M	52D	62C	62J	81C	82E	

INDIVIDUAL FILES TRIMMED FOR OFFICER CAREER BRANCHES

THE US MILITARY PERSONNEL CENTER (MILPERCEN) maintains two separate personnel files on commissioned officers' military service. One is the Official Military Personnel File (OMPF), frequently yet erroneously referred to as the "TAG File." This file is maintained by MILPERCEN's Personnel Actions and Records Directorate (PARD) and used by DA Selection Boards to select officers for promotion, military and civil schooling, Regular Army appointment, retention, elimination, and recall to active duty. The second is the officer's Career Branch Individual File (CBIF) which is maintained within the Officer Personnel Directorate (OPD) by an officer's career branch and used by MILPERCEN's career branch managers in their daily functions of managing officer assignments, professional development, and other personnel actions.

Accurately maintaining these two separate files for each officer has required a sizeable staff of administrative support personnel. Based on a recently conducted MILPERCEN study to determine where duplicative filing between PARD and OPD could be reduced, filing procedures have been revised to eliminate all nonessential documents and information from the CBIF.

Effective immediately, only the following documents will be filed in the CBIF:

- Officer Preference Statement
- Photographs
- Civil School Reports
- College Transcripts
- Individual Flight Records (most recent)
- Officer Record Brief
- Officer Evaluation and Academic Reports with related official correspondence
- Records of Punishment under Article 15, UCMJ, and Courts-Martial, and similar document filed under the provisions of AR 600-37 (Unfavorable Information)

Documents that are not needed in the CBIF are being removed from the file. Original copies of letters of appreciation and commendation and copies of citations for awards and decorations are being transferred to PARD for inclusion in the OMPF. Other documents which duplicate those filed in the OMPF are being destroyed.

THE GAP

COMMANDER'S ROLE IN AWARDING THE GOOD CONDUCT MEDAL EMPHASIZED

ALTHOUGH QUALIFYING PERIODS for the award of the Good Conduct Medal will remain the same under revised AR 672-5-1, new changes to paragraph 45 of the governing regulation reemphasizes the commander's role in evaluating the character, conduct and efficiency of deserving enlisted soldiers:

CHARACTER — The immediate commander must evaluate the soldier's character as above reproach.

CONDUCT — The record of service must indicate that the soldier has willingly complied with the demands of the military environment, has been loyal and obedient to his superiors, has faithfully supported the goals of his organization and the Army and has conducted himself in such an exemplary manner as to distinguish him from among his fellow soldiers. While any record of non-judicial punishment could be in conflict with recognizing the soldier's service as exemplary, such record on non-judicial punishment could be in conflict with recognizing the soldier's service as exemplary, such record should not be viewed as automatically disqualifying. The commander must analyze the record, giving consideration to the nature of the infraction, the circumstances under which it occurred and when. Conviction by court-martial terminates a period of qualifying service; a new period begins following the completion of sentence imposed by court-martial.

EFFICIENCY — In terms of job performance, the soldier's efficiency must be evaluated as meeting all requirements and expectations for one of that soldier's grade, MOS and experience.

US ARMY SERGEANTS MAJOR ACADEMY OFFERS NEW NONRESIDENT COURSE

A TOTAL OF 50 active Army and Reserve Component senior NCOs will be selected to attend the new US Army Sergeants Major Academy (USASMA) Nonresident Course beginning August 15, 1974, according to MILPERCEN's Enlisted Personnel Directorate.

The USASMA Nonresident Course curriculum closely parallels the Resident Course; senior NCOs will study military organization and operations, world affairs, human relations and military management. The total curriculum is approximately 625 hours: 520 nonresident hours, 60 resident hours and 45 hours of independent research.

Students will be selected for the Nonresident Course by a DA Selection Board. For this class, 35 active army students and 15 Reserve Component senior noncommissioned officers will be named. Prerequisites for the students are a PMOS score of 100 or higher; pay grade E8 (waiverable for all E9s); maximum time in service of 23 years (waiverable); and secret security clearance.

Subsequent Nonresident Courses are planned to begin annually each July, with enrollments of 200 students per class. Applications to attend Class Two—which will begin in July 1975, must reach MILPERCEN not later than October 30, 1974.

The Nonresident Course consists of approximately two years of nonresident instruction, followed by two weeks of resident instruction at Fort Bliss, Texas. Applications from overseas-based senior NCOs with more than two years remaining on their current tour assignments will be accepted; those selected, however, will attend the resident phase upon their return to CONUS.

Applications should be prepared in letter format and include the class the student is applying for; name; pay grade; most recent PMOS evaluation score and date; basic active service date; physical profile; statement as to whether applicant has graduated from either a resident/non resident advanced NCOES course; statement as to whether applicant has been selected for and declined attendance at a USASMA resident course; current mailing address and telephone number; copies of DA Forms 20 or 2-1; and waivers of time in service or pay grade, as appropriate.



THE ENGINEER

OPMS



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CHIEF'S BRIEFS

Major General Joseph Gilbert Totten was born in New Haven, Connecticut, August 23, 1788. He was graduated from the US Military Academy, July 1, 1805, and appointed Second Lieutenant, Corps of Engineers. He resigned from the Army on March 31, 1806, to accompany, as secretary, his uncle, Captain Jared Mansfield, who had been appointed by President Jefferson, Surveyor General of Ohio and the Northwest Territory.

Totten re-entered the Corps in 1808, where he remained until his death, April 22, 1864. He was an authority on sea coast fortifications, and as a member of the first Permanent Board of Engineers (established in 1816) he laid down principles of coast defense construction which were followed for more than a century. His service covered three wars, the War of 1812, Mexican War, and the Civil War. He served 26 years as Chief Engineer, 1838-1864, the longest on record.

As Chief of Engineers during the Civil War he supervised the defensive works around Washington. On the day before he died he was brevetted a Major General by Congress "for long, faithful and eminent service".

Edward B. Russell
Curator, US Army Engineer Museum

United States Army Engineer School Fort Belvoir, Virginia

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The Engineer is an authorized quarterly publication of the U.S. Army Engineer School. It is published to provide factual and in-depth information of interest to all Engineer units. Articles, photographs and art work of general interest may be submitted for consideration to: Editor, The Engineer, USA Engineer School, Fort Belvoir, Virginia 22060. Views and opinions expressed herein are not necessarily those of the Department of the Army. Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, January 1, 1974.

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UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

ABOUT THE COVER

The advent of the Officer Personnel Management System (OPMS) is symbolically portrayed on the cover of this issue by a playing card. With OPMS, your career will always be dealt a high card and your alternate speciality will always result in a winning hand. How can you sit in on the game? "Ante-up" by reading "OPMS-Anathema of Panacea for Career Development" beginning on page 11. With OPMS, the odds are in your favor.

PIPELINE. PIPE

RIBBON BRIDGE EQUIPMENT RECEIVES NEW TYPE CLASSIFICATION

A faster method of launching the boat used for the assembly of the Army's new ribbon bridge has been Type Classified as Standard. This means the method used, along with the equipment itself, is considered the most advanced and satisfactory item available to meet current military needs.

Both the new launching method and the ribbon bridge itself were developed and tested by the Military Technology Department at the US Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Virginia.

Essentially a boat cradle assembly, the new method permits the present standard 27 foot bridge erection boat to be launched directly into the water from the ribbon bridge truck transporter in a fraction of the time required using a crane. This enables the boat to keep pace with the 20 feet per minute assembly time of the actual bridge modules which are launched from the transporters directly into the water. Use of the cradle assembly reduces the boat launching or retrieval time from 30 to approximately two minutes. This also means the elimination of a 20 ton crane and the number of personnel reduced from six to three.

The ribbon bridge is now in production under a \$10 million contract with Consolidated Diesel Electric Division of CONDEX Corporation, Old Greenwich, Connecticut. Units

are expected to be available for field use in the summer of 1975. Cradles are expected to be available concurrent with the bridge units under a contract for 54 of the special boat units awarded to Pacific Car and Foundry Co., Renton, Washington.

PLANS AVAILABLE FROM OCE FOR A TRAINING ENVIRONMENT

Do you have a place for commander's call and company training? A place where all the soldiers in the unit can sit around and be close to equipment, sand tables, speakers, etc.: see a vehicle maintained; a weapon served; equipment repaired; first echelon maintenance pulled; tactical concepts worked out on a sand table?

Are you fighting the weather and noise out under the trees or trying to make the theater, dayroom or messhall do?

If the answer to any of these questions causes you irritation, makes you see red, or revivies bitter memories, then READ ON. The Office, Chief of Engineers may have a dynamic answer to your problem. It's a brand new self help company training facility to satisfy most units' needs.

The Office, Chief of Engineers has contracted to Clark, Nixsen and Owens, Architects and Engineers, to design a 40 ft x 40 ft x 20 ft high structure which will be added to the Army's Functional Component System (AFCS). The structure will accommodate all of the personnel in a company-size

unit and will solve many of the unit's training facility problems. This all-weather building is large enough to permit static display of most items of TOE equipment; use multiple sand tables, slide projectors, viewgraphs or film projectors; and allow all the personnel to see and hear what's going on.

The structure is designed to be built in usable phases; that is, foundation and roof first; siding and windows next; followed by a floor and utilities. It can be built by non-engineer units as a dynamic training project with some construction equipment and engineer support, particularly in fabricating and erecting the roof trusses.

If, this building would fill a gap in your unit's training program and you're looking for some adventure in your training, you can obtain a set of plans and bill of materials by contacting the Office of Chief of Engineers, Engineering Design Division, HQDA, ATTN: DAEN-FEE-A, Washington, D.C. 20314.

MINIATURE TORCH DEVELOPED BY MASSTER RESEARCHERS

Accidents and emergencies, such as a car wreck or many combat situations, often require a cutting torch to burn through tangled masses of metal.

Now, researchers at MAS-STER (Modern Army Selected Systems Test, Evaluation and Review) are examining a new Miniature Thermal Bar Torch

LINE. PIPELINE.

that has a greater cutting power than the familiar oxyacetylene torch.

The new torch was developed by the Land Warfare Laboratory at Aberdeen Proving Grounds, Maryland, and the MASSTER testing is putting the torch through it paces in typical field situations with soldiers from the 2d Armored Division at Fort Hood.

The torch has such a high burn temperature that it can cut through concrete, stainless steel, earthen materials and other items that the oxyacetylene torch cannot penetrate, or has trouble penetrating.

For example, the mini torch can cut through eight inches of armor plating in 39 seconds, which could be significant in rescuing men from a damaged tank or armored personnel carrier when time is a critical factor.

There are great possibilities that the mini torch could be used in non-explosive demolition roles. It could be an effective tool to replace thermite or other explosives to destroy bridges, vehicles or such things as concrete field fortifications.

The greatest advantage of the mini torch is that it can be handled by one man. It can be parachuted into an area for clandestine operations, and it can be lit and operated on land or in the water without prior preheating or special preparation.

On the other hand, the oxyacetylene torch requires a preheating period prior to operations, it is bulky, unless operated from a truck, it requires at least two men to operate it, and it cannot be parachuted into an area in a

combat-ready state.

Also, the oxyacetylene torch has an approximate heat range of 6000 degrees, whereas the mini torch can effectively operate high above this range. The mini torch does leave a much rougher cut than oxyacetylene, but this is understandable since it has greater heat level and melts more material faster.

Although the mini torch has innumerable possibilities as a military implement, the developers see it as a needed tool for humane operations.

The torch can operate off any type oxygen container and could be feasibly handled as an

emergency rescue tool in such things as car wrecks where victims are trapped inside. Any ambulance, police car, fire truck or rescue vehicle could easily carry one of more of these torches and be prepared for any type of emergency cutting operation.

The MASSTER tests of the torch include timed tests for mobility, speed of operation and assembly. Soldiers from the 1st Battalion, 50th Infantry, of the 2d Armored Division were trained to operate the torch and used it on a variety of materials, including steel I-beams, armor plating, helicopter bodies, concrete and earth.





Stop 16

Sir:

I have read several issues of your magazine and find it to be very informative in many areas; however, I feel the articles seem to avoid the area of new equipment under development.

I believe that if articles in this subject area could be published to inform field soldiers of developing concepts or methods, the Corps would receive comments from the field on proposed changes. These comments could avoid costly modifications to equipment after issue, and would reduce the number of unauthorized modifications which occur in field units (i.e. radio's moved to driver's area of Gamma Goat in troop units).

This would also allow field personnel the opportunity to relate personal experiences in order to provide research

CPT Michael F. Burns
CE

Sir:

I was very pleased to see Eugene McAndrew's article on "An Engineer in the Black Hills". (Spring 74) As a geological engineering student at the S. D. School of Mines and Technology I became very familiar with many of the places mentioned in the article.

However, I disagree with Mr. McAndrew's last paragraph: "Ludlow had a great vision, but the Indians have retained much of their land in the Black Hills." Hardly! Forced out of the holy land, the "Paha-Sapa", the Sioux finally were

settled on land that is about as worthless as the Black Hills are beautiful.

Most of the Black Hills is US Forest Service land; what little private land there is is almost universally owned by the white man. About the only Indians one now sees in the Black Hills are one or two amusing the tourists during the summer. The belief that the Indian retains much land in the Black Hills is about as worthless as the treaty that said he would.

In conclusion, Mr. McAndrew's article was excellent save for its ending. If one is to print history, it would be stated as it was . . . not as we would like it to be.

Gary C. Brown
SP4

Specialist Brown:

The conclusion of Mr. McAndrew's article was not his own, rather an added editorial afterthought. You may take some comfort in the fact that your letter was not the only one received challenging the added paragraph.

Sir:

The Spring 1974 edition of THE ENGINEER contains an article by Major McDonald entitled "It Was a Gallant Work" — the story of engineer participation in the Battle of Fredericksburg. In the article Major McDonald explains that General Burnside had available to him: The Engineer Battalion, a Regular Army unit commanded by Lieutenant Charles E. Cross and Volunteer Engi-

neer Brigade commanded by Brigadier General Daniel P. Woodbury.

As the Engineer Battalion is in the lineage of the 1st Engineer Battalion, I read the article with much interest and hope that you and/or Major McDonald might help clarify some data inconsistencies concerning the Engineer Battalion's participation in this campaign.

Our records, here in the 1st Engineer Battalion, show that the Battalion of Engineers (as our data indicates it was called) was commanded by Major James C. Duane from 1861 through 1865, which would have included the period referred to in the article. I would appreciate clarifying the command status of the Battalion during this period so that we can correct our records, if necessary.

Thank you for your assistance.

W. M. SMITH, JR.
LTC, CE

Colonel Smith:

Your letter was turned over to Mr. Edward B. Russell, Curator of the Engineer Museum, for verification. He graciously agreed to check out Major McDonald's facts and furnish you a reply. For our ever inquisitive readers, we will relate that the article, as written by Major McDonald, was correct.

Stop 16 is our "letters to the Editor" Department. We encourage timely, spirited response and constructive criticism about THE ENGINEER and its contents.

ENGINEER INTERVIEW:

With **Captain Overton Day, Captain Roy Whitman, Captain Kenneth Elrick, Captain William Korn, Sergeant First Class Theodore J. Lenegar, Staff Sergeant Earl D. Divelbliss and Staff Sergeant Donald G. Harmel.**

Operation Nimbus Moon (Land) was a joint effort by the United States, Britain, France and Russia to assist the Egyptian Government in clearing the banks of the Suez Canal of mines and other explosive ordnance. This was accomplished in preparation for the reopening of the canal to international navigation.

In the spirit of the first joint United States and Egyptian peace project, a team of engineers from Fort Belvoir, Virginia was sent to the area of Ismailia with the mission to instruct Egyptian soldiers in the training and doctrine of U. S. mine removal.

In an effort to keep readers of THE ENGINEER magazine up to date, we interviewed that team and got a first hand reaction to their mission and the country of Egypt at large. This is their story:

ENGINEER: Can you tell our readers just exactly what was the role of the engineers during **OPERATION NIMBUS MOON (LAND)?**

CPT DAY: The engineer mission was to train and advise personnel of the Egyptian Army combat engineers whose mission was to clear minefields from the vicinity of the Suez Canal. We were part of a combined task force of engineer and EOD personnel.

ENGINEER: Who made the determination for your mission?

CPT DAY: Our mission was primarily determined by the Joint Chiefs of Staff after two preliminary planning trips to Egypt. Both of these trips were supervised by Navy Personnel. Nimbus Moon (LAND) was in fact an element of the joint Army-Navy Task Force under

Navy command.

ENGINEER: What was the duration of **OPERATION NIMBUS MOON (LAND)?**

CPT DAY: The execution of the operation began 11 April 1974 and was concluded on 24 July 1974.

ENGINEER: How many personnel were involved?

CPT DAY: Eight engineer officers, 13 combat engineer NCOs and two maintenance NCOs were initially deployed to Egypt. In May, some personnel returned to the states.

ENGINEER: In what capacity were the engineers utilized?

CPT DAY: We were organized operationally into Battalion Advisory teams. The engineer side of the task force dealt primarily with the 209th Egyptian Engineer Brigade. The brigade consisted of brigade headquarters and four organic battalions. Their mission was to clear minefields the full length of the Suez Canal, approximately a 100 mile stretch in length and a depth of 250 meters. This area pertained to both banks, with the exception of certain built up areas. There the depth was increased to 500 meters. The east shore of the Great and Little Bitter Lakes required no clearance. While the US engineers were organized into four BN Advisory teams, only three of the four Egyptian BNs were utilized on the canal clearance. Each BN advisory team consisted of an engineer captain and two or three engineer E-7 or E-8. The two



Members of the Fort Belvoir Training Team are: Front Row, (left to right), SSGT Earl D. Divelbliss, SSGT Donald G. Harmel, SFC Theodore J. Lenegar; Back Row, (left to right) CPT William Korn, CPT Overton Day, CPT Kenneth Elrick and CPT Roy Whitman.



mine detector personnel were utilized for the purpose of conducting actual mine detector maintenance and subsequently training Egyptian personnel for that purpose.

ENGINEER: How were you received by the Egyptians?

CPT KORN: The Egyptians were very warm and friendly. They seemed extremely happy that Americans had come to their country in order to provide assistance. Any rumors that we had heard of the Americans being treated otherwise proved very false.

CPT WHITMAN: I felt that we were not only well received by the Egyptian Army personnel we worked with, but also by the civilian community. In some instances we were even taken into their homes and welcomed as a member of their family.

ENGINEER: Did you encounter any language communications problems?

CPT WHITMAN: Most of the people we worked with spoke and understood English. Keep in mind however, that all our contacts were with the civilian officials of the Suez Canal authority and Egyptian Army Engineer Officers. Most of the enlisted personnel spoke or understood little English. American tourism was a very going concern over there, so most taxi drivers could get you where you wanted to go.

ENGINEER: What was your impression of the Egyptian combat engineers?

CPT KORN: I felt that the

Egyptian engineers were more combat experienced than ourselves. Remember, they've been engaged in a war since 1967, so their actual experience is far greater. As far as their use of equipment and materiel, they may not have the capabilities we do, but they still accomplish the job by benefit of sheer numbers. Their troops are utilized more for labor type tasks, whereas a US engineer would utilize some form of sophisticated equipment.

CPT DAY: In fact, the 209th BDE appeared to be a pioneer-type combat engineer unit and not heavy equipment. The Egyptians do have other engineer units that are more tailored to specific missions, however, we had no contact with them.

CPT ELRICK: My over all impression was that their performance on the clearing operation was efficient and effective.

ENGINEER: O.K. Now back to your actual mission. Tell us how you went about establishing an operational concept.

CPT DAY: Our operational concept consisted of three phases. The first phase was that of US engineer conducted training for an Egyptian officer cadre. The second was that same cadre training their own troops, with the US engineers advising and assisting in said training. The third or final phase was that of the US engineers advising actual clearance operations.

CPT WHITMAN: Phase one consisted of three days of training by two separate groups meeting at two different times. Each group

received one day of demolition training under Captain Korn, one day of minefield breaching under CPT Elrick and one day of mine detector training, which I was in charge of.

CPT KORN: My phase of demo training was broken down into three areas, nonelectrical priming, electrical priming and detonation cord priming. We hadn't any real feeling as to the Egyptian Officers expertise, so we began with our basic demo procedures. We soon discovered our techniques were similar. They had experience with our TNT, some Italian dynamite, etc., so this was more or less a refresher course for them on our nomenclature and equipment. This expedited the natural training phase.

CPT WHITMAN: My mine detector training began with classroom instruction on the nomenclature of the mine detector, its parts, general operating procedures and how the detector functions. The metal mine detector they had been using was very similar to ours, so the group adapted very quickly. The training progressed to the field where actual detection for unused live mines of various types took place. The Egyptian officers seemed to like our metal mine detector very well because of its sensitivity. I might add we only trained them in the use of the AN-PSS/11 metallic mine detector.

CPT ELRICK: The third day of instruction was designed to show the Egyptian officers the techniques used by US engineers for clearing and breaching minefields. Considering the fact they

had seven years of experience in this task, our procedure was to show them the techniques the US engineers utilized in location and removal. This was demonstrated by use of detectors and probing. In the final analysis, since both our techniques proved quite similar, it was merely a question of comparison and selection.

ENGINEER: The words "classroom training" and "field training" keep occurring. Why the distinction?

CPT KORN: In order to conduct thorough training, it was necessary to expose the student to an indoor and outdoor phase. Indoors he learns the basic applications, outdoors he accomplishes the task. It's that simple. Take demo training, for example. After a brief class on how to prime TNT with a non-electric cap, we'd take the student to a table containing the needed gear and let him go through the procedures we had outlined. Then it was outside to the demo range for follow-through.

CPT WHITMAN: Detection training was the same. Each group, consisting of about twenty-five men, with one US Advisor for every three or four Egyptians, would go through a practical exercise. The US advisor would put the mine detector into operation then break it down. One Egyptian officer would in turn train the other two or three in the same operation.

SGT LENEAR: The system worked well. One group of Egyptian officers and one US advisor working as a team. The Egyptian cadre in turn would train their NCO personnel.

SGT HARMEL: For example, Sgt. Divelbliss and I trained one Egyptian colonel, who was accompanied by an NCO. In the next two days he trained two additional NCOs, with us acting more or less as supervisors. These individuals in turn went to

the field and trained personnel from their respective battalions.

ENGINEER: SGT Harmel and SGT Divelbliss. You gave actual training in addition to that given by the US Officers?

SGT DIVELBLISS: Yes, in maintenance of the detector itself. We pointed out such things as the fragility of some of the components, care and cleaning, etc.

ENGINEER: How about your advisory activities? Were you ever in any apparent danger?

SGT LENEAR: Not that any one was aware of at the time. I believe that the Egyptian officers were constantly looking out for our welfare.

CPT ELRICK: We were specifically told we would not handle any explosives, demolitions or mines at any time during our advisory role. We were there to advise and not to participate.



ENGINEER: As advisors to the 209th Brigade, didn't you actually get into the field on a delayed basis?

CPT DAY: The canal clearance began on 12 February while our participation in the actual advising of clearance began on 15 May. Up to this point the brigade had had three full battalions involved in clearance operations. After 15 May the Egyptian clearance effort started to decrease and by the end of June has ceased. Our involvement occurred at a time

when only significantly difficult clearance projects remained. The bulk of their minefields had been pulled by this time and as of 30 May the brigade had cleared approximately 146,000 mines.

CPT WHITMAN: Subsequent rechecking of mine fields which were already cleared prior to our arrival there was accomplished with our AN-PSS/11 mine detector. This produced additional mines that had been missed.

ENGINEER: Everything sounds like it moved smoothly and efficiently. You were probably furnished precise mine-field records.

CPT ELRICK: Not quite. I did encounter several different recording forms the Egyptians had available to them but it was at best a draftsman's sketch of the area of installation. The writing was always in Arabic but I could discern some of the numbers,



possibly the pattern, turning point and so forth.

CPT DAY: I want to point out that this was the **only** time actual recording forms were encountered. Generally, the recording consisted of an overlay to scale, the locations of mine fields and some figures that might or might not be the number and types of mines. This was only on their side of the canal I might add. The Israeli side lacked both accurate recording and reconnaissance.

ENGINEER: Captain Elrick, you mentioned minefield patterns. Were there any standard patterns in the operational area?

CPT ELRICK: In every instance that either I or my NCOs encountered the pattern employed was the basic Soviet row mining type pattern. In this pattern, mines are simply spaced in rows four meters on center for anti-tank types and two meters for anti-personnel types. The turning points were in increments of eight meters at a time, in sixteen or twenty-four meters, then the row would angle out at a different azimuth. Picket points marked the beginning of each row. This in turn made removal quite simple.

ENGINEER: That sounds too simple. Anybody encounter anything different?

CPT DAY: No. For lack of a



better word, this "pattern" method seemed to be used with uniform regularity by both the Egyptians and the Israelis along both sides of the Suez canal. In not one instance was the six cluster pattern as known in our doctrine used. We feel this is significant in describing the ease with which the Egyptians were able to remove most minefields.

ENGINEER: What types of mines were encountered along the canal?

CPT DAY: There were actually thirty different types of mines encountered in the canal area. These were divided evenly with the Israelis and the Egyptians using 15 different types each.

ENGINEER: Encounter any sophisticated hardware or real problem areas?

CPT ELRICK: Sophisticated hardware? No. Problem areas? Yes. Along Lake Timpsa, near Ismalia, masses of the Soviet TMN-46 mines were employed in the water using a tilt rod type fuse. The mines were encased in concrete and placed along the shoreline to prevent amphibious landings. Removal was complicated by the growth of water hyacinths in the canal along the shore line which had covered these mines. Since the tilt rod fuse is very sensitive, clearing the plants so the mines could be located visually was exceptional-



ly dangerous. A person moving around in that morass would detonate a mine.

CPT WHITMAN: The Russian PMN non-metallic personnel mine was another problem. Since it only takes a very low pressure to be applied to the pressure plate to detonate, probing is extremely dangerous. Even though it contains metal and can be detected by our metal detectors, its sensitivity makes it difficult to deal with.

CPT DAY: This mine was also used directly on the canal ledge just above the water line. In many cases, fortification work subsequent to the minefield installation or banks sloughing off caused these mines to become buried very deeply in dense soil.

ENGINEER: How was the problem solved?

CPT WHITMAN: In areas of deeply buried mines, the Egyptians would dig adjacent to the rows of mines about a meter deep or more and then use bulk explosives. Everything was used in this hole. Everything from Russian clay TNT, Italian Dynamite and old anti-tank mines that could be recovered. Primed with detcord, the mines would be detonated sympathetically.

ENGINEER: Now that we're on special situations again, were there any instances of



mines being recovered for possible re-use?

SGT LENEGAR: When we arrived at the 31st Egyptian Engineer Battalion, we did notice a few thousand mines stacked at the training area. We were told they were stacked for detonation, but it looked as though they were going to re-use them. However, mines that could not be removed conveniently or that had fuse wells that hampered removal were blown in place.

ENGINEER: Back to the location and detection of mines. What types of equipment did the Egyptians use?

CPT ELRICK: In most cases it was the good ole probe. Some said it was a Soviet innovation, some said Egyptian, but it didn't matter. It was about two meters long and a man could walk through a minefield with it unlike the US probe which has the man down on his stomach or hands and knees. In addition to that, they had a rake about four meters long which they would use in grassy antipersonnel mine fields. The rake would locate the mine and the personnel would either disarm or detonate them as the case might be.

ENGINEER: You've discussed the probes, but what about the electronic detectors that are used by the Egyptians?

CPT WHITMAN: I personally saw some old US metallic mine detectors and was told that they had used some Russian mine detectors prior to our arrival.

ENGINEER: Earlier in this interview you mentioned that you trained the Egyptians in the use of the AN-PSS/11 metallic mine detector exclusively. Was another type of detector taken along? If so, why wasn't it used?

CPT WHITMAN: Yes, the ANPRS-7 non-metallic mine detector. The reason why it wasn't used is simple. When we first received our mine detectors upon arriving in Egypt, we immediately ran checks on them to see if they were operational. Our maintenance people were going over them, calibrating them and ensuring that they were operating on the correct frequency. It was then we discovered that the non-metallic mine detectors would not give us reliable detectability due to the immense

dry soil area.

SGT DIVELBLISS: Sgt Harmel, Cpt Whitman, a couple of other NCOs and myself took it through the mock minefield we had set up to see what depths it would detect. We found it would detect **very few** mines even along the canal shore line. This left us with very little reliable detection.

ENGINEER: It wouldn't work where it was dry and it wouldn't work where it was damp. Did you test it under any other conditions?

SGT HARMEL: We even took it down by the water that edged the mock up field, placed the mines in holes which had water seeping over the mine itself and again the only mines detected by the ANPRS/7 were metal mines, not non-metallic.

ENGINEER: The group consensus says the AN-PRS/7 is less than desirable. Anybody got some positive recommendations?

CPT WHITMAN: It is my opinion that some warning should be sent to the field immediately. The detection ability is not the only limiting characteristic of the detector. It requires a homogenous type soil and cannot be operated in any vegetation, because the mere touch of a blade of grass against the side of the search head gives a false signal. I think the whole unit should be re-evaluated and taken out of the field because of the overwhelming limitations. It is not designed to detect anti-personnel mines and where anti-personnel and anti-tank mines are emplaced together, it could become a real sticky situation. As a combat engineer, I wouldn't ask any troop to enter a minefield with that detector.

ENGINEER: What about the AN-PSS/11 and its proponents?

CPT ELRICK: There is no doubt that the AN-PSS/11 is a tremendous detector for locating metallic objects. The Egyptians thought it was much better than any detector they had worked with. There were some problem areas in a combat zone where the ground had been plowed over and was saturated with metallic objects such as shrapnel and discarded ammunition. You can get all kinds of signals with this baby because it's so sensitive and each signal means the operator has a probe to determine whether he's got a mine or a piece of small metal. In a large scale operation this takes a considerable time to get through a minefield and I think the US Army will have to evaluate its hasty breaching techniques using this detector.

CPT WHITMAN: Even the many so-called non metallic anti-tank mines contain a small amount of metal such as a striker or spring in the fusing system can be detected using the AN-PSS/11.



ENGINEER: That means if an area has been fought over we really have no recourse for detecting mines other than the "good ole probe". Well, maintenance on a probe should be simple enough. How about problems on our detectors?

SGT HARMEL: Very little. Two AN-PSS/11s had gotten sand inside the handle and the collar

used to tighten the short handle and the extension pole. When the collar was tightened it resulted in some damage, but nothing that couldn't be prevented by supplying a brush along with the detector.

SGT DIVELBLISS: We also had one instance of the search head working the connections of the short and long extension loose and stripping the end of the extension pole.

ENGINEER: Quite a few things have been discussed here, now let's turn our attentions to the benefits derived from the operation.

CPT DAY: I feel that doctrinally we have certain problems within our own counter-mine operations. We were exposed to very simple types of mining in the Suez Canal area and very efficient clearing operations. Our own mining doctrine is very complex — complex to the point that I feel we are



hurting ourselves concerning efficiency. Our doctrine on counter-mine clearance is treated quite vaguely and generally. Everything is based on an ideal situation, which is not a suitable basis upon which the small leader in the field can develop clearance procedures for a specific situation.

CPT WHITMAN: We should

also realize mines are not a thing of the past and will be used in ground combat again and again. The US Army should place emphasis on training in this particular area in the service schools and in field units.

ENGINEER: Aside from the usual camel rides, the food, the belly-dancers and, of course the pyramids, can one of you come up with a concrete example of mutual beneficiality?

CPT WHITMAN: While I was working in Suez, President Amrwhar Sadat came to visit Suez City and view the destruction that had occurred there. I had an opportunity to chat with him for a while and passed on to him my personal American flag. He appeared to be very moved by this, and looking at the flag first, then at me said that he would cherish this always. I think that's the way we will all feel about our mission over there in the time to come.



OPMS

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Colonel Carl P. Rodolph, Jr.

ANATHEMA OR PANACEA FOR CAREER DEVELOPMENT

As a result of the withdrawal of U.S. Military Forces from Vietnam and a corresponding reduction in the active force structure, the Army has had the opportunity to reflect upon personnel "lessons learned" and to develop a force structure, consistent with available resources, to be responsive to future military requirements. Since "people" are our most important resource it is logical to expect that personnel career development programs would receive priority attention — and they did! In March of this year DA Pamphlet 600-3, entitled "Officer Professional Development and Utilization", was released to the field for implementation. This document, in effect, established a "road map" for the Officer Personnel Management System (OPMS). OPMS, for the majority of

career branches, represents a significant shift from a rather rigid, long existent, traditional value system of personnel management to one in tune with providing officers, trained in proper specialties and skills, to meet current and future Army requirements. Further, OPMS is the most evolutionary change to the Army's Officer Personnel System since 1947 and is a response to a changing requirements and the military environment. OPMS has three main objectives for officer professional development:

- To develop officers in the proper numbers and skills to meet Army requirements and maximize the individual officer's abilities, aptitudes and interests.

- To assign officers based upon Army requirements and within capabilities in consonance with individual competence and desires.

- To improve the overall motivation and professional satisfaction of the officer corps.

There are many factors which prompted the development of OPMS. In recent years the officer corps has decreased in size, the need for specialization and functionalization has increased, the Army has insufficient officers trained in required specialties, command opportunities have decreased, the previous promotion systems have encouraged generalization versus specialization, and professionalism and career satisfaction need to be improved. As previously stated, DA Pamphlet 600-3 promulgated the new officer personnel system, however, because of the voluminous size of the document, rather strong feelings and experiences of many senior officers, and a general suspect of departing from traditional patterns, the officer corps has not yet fully "signed up and climbed on the OPMS band wagon". Undoubtedly, many will continue to have strong reservations and will reserve final judgement until results of future selection boards are posted. However, it is important that every officer fully understands that OPMS is being implemented and DA is totally committed to this program. OPMS is now a fact of life!

The questions for the young company grade officer and some majors are: Is OPMS the anathema or panacea for career development? How has it changed from the old system? How will the new system affect me? Should I generalize or should I strive to be a specialist? What alternate specialty is best for Engineers?

These are challenging questions and the type received each day by military personnel officers assigned to Engineer Branch, Officer Personnel Directorate (OPD), Military Personnel Center, HQ, DA. Before launching into OPMS, it would be worthwhile to place the current professional development in perspective. The new DA policy to a great extent formalizes an informal system that has been practiced by Engineer personnel managers for years. Engineer officers have been developed to be highly competitive for both branch material and immaterial assignments to meet Army requirements. Therefore, for the Engineer officer, it represents a continuation of previous efforts. With this background in mind now, let us address "How has the system changed?" and "How does it affect me?". You must develop yourself in depth to serve in two of the Army's specialty areas. This represents a shift from the former policy which fostered the generalist who

perhaps became a token specialist. Under the new system everyone must develop in-depth expertise in two specialty areas. Your basic entry specialty is Engineer. Within the Engineer specialty, the primary development is in one or more of the following areas: combat, construction, facilities and topographic engineering. An officer, during his first 8 years of commissioned service, will become qualified in a broad spectrum of jobs within the Engineer specialty. The larger the spectrum and the deeper your expertise into the many facets of military engineering the greater your value as an Engineer. But keep this in mind, of all the qualities required for success in the Engineer specialty, your *ability* to command still dominates.

Following the first 8 years of commissioned service, an Engineer officer will select an alternate specialty and can expect to receive future assignments in both the Engineer specialty and his alternate specialty on an alternating basis. The normal Engineer company grade career development will continue, as in the past. The first eight years will consist of: attendance at the Engineer Basic Officer Course (EOBC), assignment with troops to gain command and staff experience, attendance to Engineer Officer Advanced Course (EOAC), company command, attendance to civil schooling (depending upon academic background, overall manner of performance and DA educational requirements) and assignment to an Engineer functional utilization. It is the Engineer Branch goal to assign all officers to troop units following EOBC graduation to become thoroughly grounded in troop unit operations.

Your alternate specialty is largely your choice consistent with Army requirements. For success, qualities and attributes must match those needed in the specialty you choose. The Army is large and its requirements are diverse but soldierly qualities are and will remain fundamental keys to success. The successful officer will not be the technician who happens to be wearing the uniform, he will be the *soldier* who is well versed in the technicalities of his specialties and who demonstrates his technical capabilities in performance meeting Army requirements.

We just said it, "Army requirements". *Requirements Drive The System*. This is an age old truism and still true under OPMS. The statistics show that beyond the eight years of service nearly 50 percent of the requirement for Engineer officers is outside the "pure" Engineer specialty. So the requirement for you to develop additional skills is real and not contrived.

Which specialty is best for Engineers? This question gets at the heart of the whole matter. The answer is simple. There is no one alternate

specialty for engineers that is better than another, but there is very definitely an alternate specialty that is best suited for you. It is your job to figure out which one that is with the guidance of your personnel manager. As was stated before, the selection of an alternate specialty is dependent upon Army requirements, individual military experience and personal preferences. Normally, field grade officers, particularly Engineers, already have established skills in one or more alternate specialties. This fact was particularly evident during a recent evaluation which culminated in the final designations of alternate specialties for lieutenant colonels. Approximately 80% Engineer lieutenant colonels received their first choice and 98% received no less than their second choice. A recapitulation of these results is delineated below.

ENGINEER LIEUTENANT COLONELS OPMS ALTERNATE SPECIALTY DESIGNATIONS

Specialty	Code	Percent
Research & Development	51	20.0
Operations & Force Development	54	12.7
Foreign Area Officer	48	9.8
Atomic Energy	52	9.2
Education	47	8.5
Personnel Management	41	7.7
Supply Management	92	7.5
Procurement	97	5.9
OR/SA	49	3.5
Maintenance Management	91	3.0
Tactical/Strategic Intelligence	35	2.5
ADP	53	2.3
Comptroller	45	2.2
Construction/Marine Material Mgmt	78	1.3
Logistics Services Management	93	1.0
Aviation Material Management	71	.7
Tank/Ground Mob Mat Management	77	.7
Personnel Administration	42	.5
Information	46	.4
Missile Material Management	73	.2
Munitions Material Management	75	.2
POL Management	81	.2
TOTAL	—	100.0

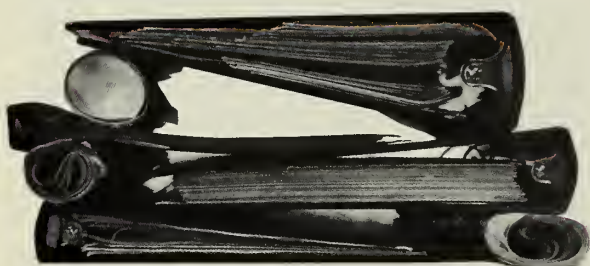
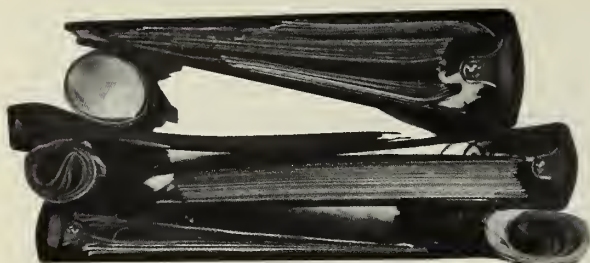
Now that lieutenant colonel designations have been completed, the next DA target group is majors and captains. Records will be reviewed by DA personnel managers to evaluate both education and experience for alternate specialty designation. Although Army requirements always drive the personnel system, individual desires and personal preferences are considered. If there is some doubt concerning your experience or selection, contact Engineer Branch for advice. Additionally, remember the alternate designation is not irrevocable and can be changed after a period of 2 years.

The importance of OPMS is properly reflected in the forwarding statement made by former Army Chief of Staff, General Creighton W. Abrams, when promulgating DA Pamphlet 600-3. He said:

"The Officer Personnel Management System described in this Pamphlet is the blueprint for the development of the Army's officer corps of the future. This system will provide officers the opportunity to develop the professional skills that the leaders of tomorrow's Army will need. I commend this Pamphlet to your study, but caution you to bear in mind that how well you do in the Army depends not on our system of management but rather on your individual efforts and dedication to service."

The Army's leadership is dedicated to total implementation of OPMS. Assignments currently are being made to satisfy Army requirements in the alternate specialty areas. This effort will be fully implemented once alternate designations have been finalized for both majors and captains during CY 1975. OPMS is an evolutionary professional development program that should provide the achievement of a successful military career. As General Abrams has suggested — each officer must study 600-3 and become familiar with the options. OPMS is neither the anathema nor the panacea for career development. As General Abrams indicated, there is no management system which guarantees success. Each officer must conduct a self analysis, become familiar with Army requirements, consult with personnel managers, evaluate personal goals and select the career progression route which satisfies both Army and individual needs. Once this "blueprint" has been developed, then it should be implemented with nothing less than quality performance.

Colonel Carl P. Rodolph, Jr., is the Chief of Engineer Branch, Officer Personnel Directorate, Military Personnel Center, The Department of The Army. Since being commissioned in 1952, he has served in a variety of command and staff assignments to include construction units in Europe; Vicksburg Engineer District; HQ, 8th US Army, Korea; tours with both ACSI and ACSFOR on the Army staff; and a previous tour in the Engineer Branch, OPD. Colonel Rodolph's Vietnam tours include assignments as engineer, 173d Airborne Brigade (Separate), CDR, 577th Engineer Battalion (Construction) and CDR, 326th Engineer Battalion, 101st Airborne Division (Airmobile). He most recently served as CDR, U.S. Army Engineer School Brigade, Fort Belvoir. Colonel Rodolph is a graduate of the Engineer OAC, the Command and General Staff College and the National War College. His civilian education includes degrees in Industrial Management, Civil Engineering and International Relations. Colonel Rodolph is a registered professional engineer.



A new type manual is being developed by the U. S. Army Engineer School that will contain all the MOS related information a soldier will need to know to perform his duties. The manual could allow for a whole new set of potential applications including revolutionizing the individual training process. Unfortunately, the program is still plagued by shortcomings that threaten the usefulness of the manual.

The Soldier's Manual is an answer to the TRADOC requirement that each branch of the Army prepare a manual that will address each MOS under their particular control. The requirement arises from the recognized problem that it is not uncommon today to find soldiers unsure of what they are supposed to be able to do, or unable to complete tasks that should be within their capabilities.

The Engineer version of the Soldier's Manual is being prepared at the Engineer School at Fort Belvoir. The School has defined its guideposts for the preparation of the manual to be:

- It will belong to only one soldier. Each soldier will be issued the Soldier's Manual for his particular MOS.
- It will clearly define the soldier's responsibility with regards to his MOS duties.
- It will contain all MOS related information that the soldier will need to perform his duties.

Further, the project group tasked with the preparation of the initial draft of the manual was given special guidance with regards to the overall development of the manual. As a result, the new manual uses only information and terminology

CPT Robert Sperberg

THE **ENGINEER** *SOLDIER'S* **MANUAL**

geared to the average educational and experience level of the using soldier. The text is written in the second person so as to give the manual a personal flavor and talk the soldier through the material. Also, all technical information is presented only to the skill level required to make use of the information.

As prepared by the project group, the manual is organized into chapters, with Chapter 1 being the introduction chapter. However, this introduction chapter, besides explaining how to use the manual, will also provide information on what the soldier must do to gain his next promotion. In addition, it will outline his progression from his present rank all the way to Sergeant Major, including all schools and special training required. This is a feature that no other manual has.

Subsequent chapters would contain the information the soldier would need in the performance of his MOS duties. These chapters contain a series of tasks outlining all the required missions a soldier might have to perform within his skill level and MOS. These tasks are broken down into four parts:

- "Task Statement" or what the soldier must be able to do.
- "Condition" which tells the soldier what he needs to complete the task stated above or under what special environmental conditions he must be able to accomplish the mission.
- "Standard" is the degree of proficiency the soldier must demonstrate in the performance of the task.
- "How To Meet The Standard" is the main part of the manual which explains the step-by-step procedures that the soldier must follow to complete the task within the constraints of the conditions and standards set above.

This manual, in its completed format, will certainly improve several areas of individual training currently causing difficulties. For example, all the questions on MOS tests will come from the text of the Soldier's Manual. Since all information for a particular MOS is in the Soldier's Manual, and each soldier has his own copy, there will be an end of the requirement to maintain the large MOS libraries.

The manual's format also provides for a "Record of Performance." This will be a table in the manual with all the tasks listed and a space for the signature of the soldier's supervisor. When this space has been signed, it means the soldier has successfully performed the task required, similar to the Boy Scout merit badge card. This record readily lends itself to two uses. First, it can be used as a promotion guide. When a soldier gets all

the tasks for his next skill level signed off, he becomes *eligible* for promotion to that skill level. Second, for union recognition, these scoreboards will demonstrate to unions that certain skills have been mastered. Already some unions have expressed interest in providing apprentice-hour credit towards journeyman certificates for completed performance records in related skills.

Despite the possibilities that the manual has in these and other areas, its application to the active Army has been delayed due to five major problems:

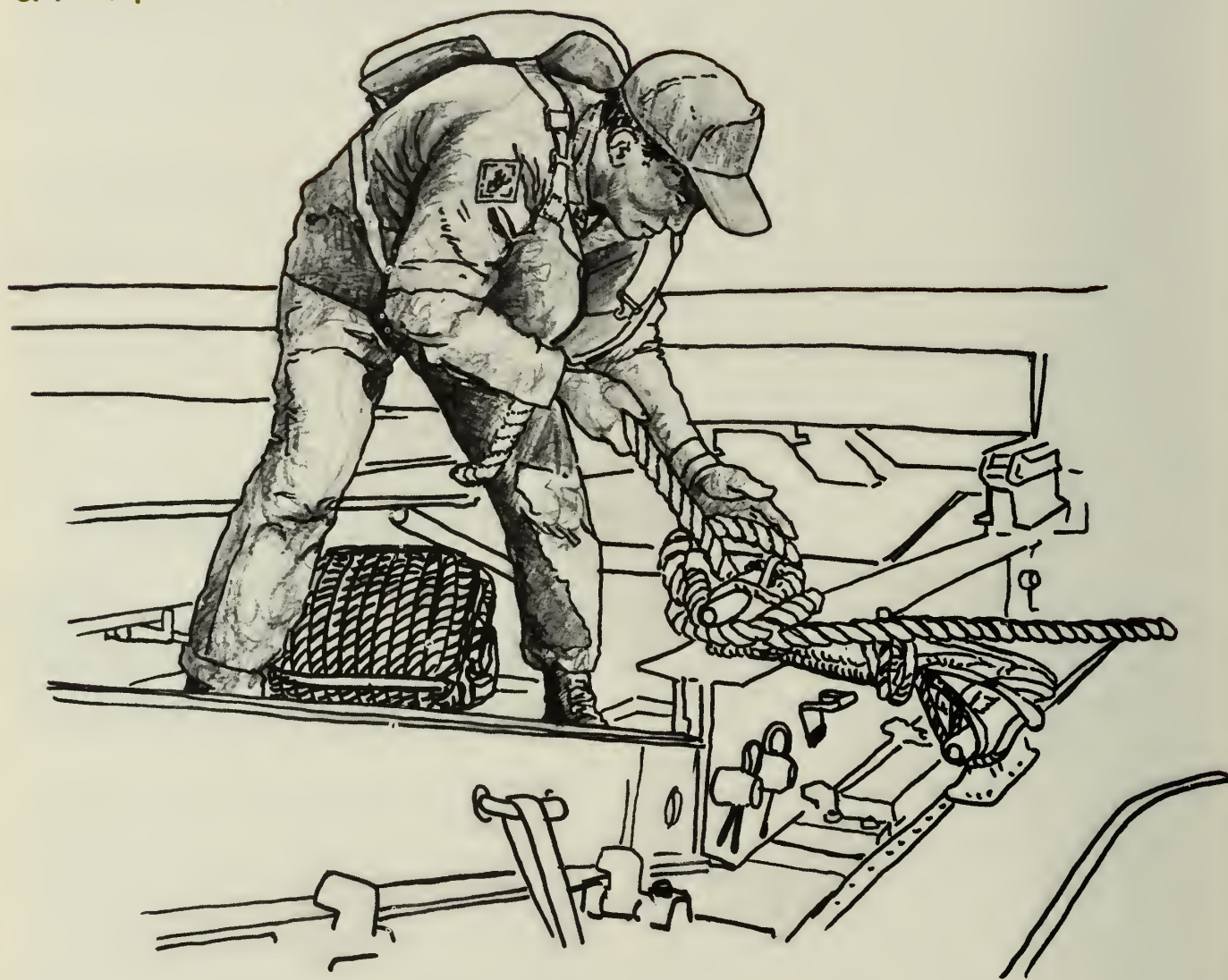
- There is a need for an accurate and realistic job and task analysis for each MOS and skill level. This ensures the reliability and creditability of the manual. The manual must contain all pertinent MOS data, no more, and no less.
- There is a need to determine whether there is an inclusion of either too much or not enough information for each particular task. With too much information, the book is too bulky. With not enough information, we leave the soldier with insufficient data to perform the tasks assigned.
- As a result of the above problems, the size and final organization of the manual is still a matter of debate.
- The job performance record poses some difficult problems, especially finding a method of preventing forgeries of supervisor's signatures.
- There is also some question as to the field usefulness of the manual once it has been issued. Will it be too big? Will the individual soldier use it?

Though these problems are still being studied, it is the opinion of the project group that, after some additional refinements, a manual that not only meets but also exceeds TRADOC requirements will be developed. Should it be accepted by TRADOC, the Engineer Soldier's Manual has the potential of improving the quality of the Corps of Engineers overall. It could become a truly useful and tremendously versatile manual.

Captain Robert J. Sperberg was a project officer with the team from the Training Programs Division, Deputy Commandant for Combat and Training Developments, U.S. Army Engineer School, Fort Belvoir, which prepared the first draft of the new Engineer Soldier's Manual. He has a B.S. degree in civil engineering from the Virginia Military Institute and is an engineer-in-training in Virginia. He recently returned from a tour with the 9th Engineer Battalion (Combat) in Europe. Currently he is attending the (3-74) Engineer Officer Advanced Course and ultimately will be assigned to the Republic of Korea.

RIVER CROSSING

CPT Benjamin F. Heil, Jr.



It is six o'clock in the morning of the second Sunday in September. You are on the Rhine River near Leeheim, West Germany where during World War II, General Patton crossed his Third Army to continue its advance into the heartland of Germany. The 547th Engineer Battalion (Combat) is commencing construction of an eleven hundred and eighty-five foot class sixty floating bridge on the shore opposite that used by General Patton. The "Bridge Builders" have prepared for this day through extensive training and are set to challenge the modern-day record for closure. The week's training period immediately preceeding the closure

attempt has resulted in many corrections and innovations towards reducing construction time. Bridge erection boat control has been determined to be the largest contributing factor to timely closure. A new method of boat control has been selected for use by the commander and staff. The 547th Engineer Battalion is prepared to prove or disprove the concept that the use of a central boat control for all bridge erection boats on a major river crossing operation is effective, efficient, and time saving.

The boat control organization has been extracted from the normal assets of the supporting

G OPERATIONS

and supported units with little, if any, detraction from their ability to accomplish assigned tasks. The headquarters company commander has been designated as the boat commander and has selected a location for his control headquarters that affords him an unobstructed view of two-thirds of the entire construction site to include the complete centerline. Communication nets and personnel have been designated for the boat control element's use. The boat commander has a direct radio link with the construction commander, the battalion operations officer who is located in the tactical operations center. Additionally each boat crew can communicate with the control element or any other boat crew through a separate net. Bridge erection boats have been allocated and will be utilized according to normal tasking. Each of the six construction sites has a single construction boat. Six two-boat teams have been allocated to provide raft delivery. Additional boats have been allocated for centerline, safety, and the commander. None of the assignments to the boat control organization has depreciated the ability of the other construction elements.

The central boat control team concept provides a strong, responsive tool for the construction commander. All of the boat and boat operator assets of the three participating float bridge companies have been pooled, thereby providing a complete team of boats and operators from a situation where there were boats with no operators and operators with no boats. Special teams of maintenance and heavy equipment personnel have been assembled and trained to man the raft delivery crews. In this manner the necessary final closure manpower has been provided without weakening the committed line company strength. All boats remaining uncommitted after the initial allocation have been formed into a reserve and located with the boat commander. This effective and efficient use of available resources detracts little from the operation and, when coupled with the reserve, provides the boat commander with all of the necessary assets to accomplish his mission.

The establishment of a central boat control has provided flexibility and a subsequent strong possibility of time reduction for the crossing operation. Breakdowns of critical boat assets are easily remedied by dispatching other boats from the

constituted reserve which is directly available to the boat commander. As six-float rafts are completed at the construction sites, the delivery teams can secure, remove, and dock the rafts away from the construction sites. This system precludes cluttering and congestion around the construction sites, thus facilitating movement and accordingly cutting construction time. Continuous final closure can be assured by proper allocation of available assets by the boat commander. No construction site personnel are required at centerline for raft marriage, thus freeing crews for actual construction work. No delivery teams are idled while waiting for completed rafts at designated construction sites since the boat commander can allocate specific crews to specific sites as rafts near completion. The raft delivery teams have the capability to dock rafts on the far shore prior to the raising of the highline. This insures a continuous and responsive flow of completed rafts at the appropriate time for effective centerline marriage. Centralized control under a strong boat commander facilitates construction and provides timely, responsive boat assets.

It is now 9:25 A.M. and the first vehicle starts to cross the bridge. The 547th Engineer Battalion has completed the bridge in a record three hours and twenty-five minutes, thus continuing its three year domination of Rhine River closure times for Europe. Additionally, the battalion has surpassed its best closure time by forty minutes.

The results are in and conclusive. The only major change between past and present bridging operations has been the use of a centralized boat control. The 547th Engineer Battalion has definitely proved that the use of a central boat control provides effective, flexible and responsive boat assets for major river crossing operations.

Captain Benjamin F. Heil, Jr., is a recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia. He has commanded companies in Vietnam and West Germany. He participated in three Rhine River closures, the last during September 1973 when he served as the 547th Engineer Battalion Operations Officer. He is presently pursuing a Master of Science Degree in Civil Engineering at the University of California, Berkeley.



INCENTIVE TRAINING

How much does a combat engineer Private in MOS 12B10 need to know before he joins his unit? The answer will vary with the type, location and mission of units. Most commanders and noncommissioned officers will agree, "Give me a man who understands the basics of combat engineering, knows the school of the soldier, is motivated, and confident of his ability to learn. I will train him for accomplishment of the mission assigned to my unit." This is the challenge for the A.I.T. commander today — PRODUCE SUCH MEN.

A consensus of opinion of the 1st Battalion (Pioneer), 4th Advanced Individual Training Brigade (Engineer) at Fort Leonard Wood, Missouri, was that the Army Subject Schedule 12A10 contained too many boring and repetitive classes. The training appeared to be geared for the average or below average man who was being given his only opportunity to learn something about combat engineering before becoming a replacement in the RVN is no longer an area of assignment. The draft is over. Above average volunteer soldiers do not want to be taught at a pace below their capability to learn. AWOL rates are high, in excess of 10% for most cycles, and at times as high as 20%. Sick call rates sometimes average more than 2 times per man during the 7 week cycle.

When the trainee strength figures went to less

than half the programed capacity in the summer of 1973, the 1st Battalion and the Pioneer Training Committee in the 4th Brigade were combined and challenged to write a new proposed training program. During the 28 day period that the 1st Battalion was out of cycle, many of the Drill Sergeants and support personnel worked elsewhere in the Brigade. All the trainees were channeled into the 2d Battalion.

A network analysis was prepared listing all the steps and sequence of the study. The entire 12B10 technical program of instruction was reviewed in detail using the systems engineer "Task Analysis" approach. Many areas presented were not "required knowledge" for the combat engineer from his AIT experience and were eliminated. Many subjects had excessive time devoted to practical exercises which were eliminated. The basic knowledge to be imparted did not change. Repetitive and boring items of instruction were removed. The goal was to produce a well motivated, highly competent soldier who could function as a private or PFC in a field unit.

The program which was developed and tested reduces the length of the course from 204 hours to 112, or from seven weeks to four. In addition, the highly motivated and better educated soldiers are challenged to complete this course in only three weeks by taking classes on Saturdays.

Specific comments concerning changes to each

of the technical subjects taught follow:

a. Engineer Tools: During the practical exercise (PE) portion of this subject, projects such as the construction of buildings, picnic tables, etc., resulted in individuals remaining at the same task for 9 hours, i.e. sawing studs to length. Concentration has been shifted from construction project completion to learning how to use tools, and eliminating the hand tools which are easily learned or already known by 99% of the trainees.

b. Vehicle Operations: The driving time has been reduced by 4½ hours. Eliminated also were techniques of vehicle recovery and dump operations. The original purpose of this training was to qualify a man enroute to RVN to move a vehicle in an emergency situation if the assigned driver were to be killed or wounded. The reduced training still accomplishes this. In order to qualify for this training, an individual must have a Driver's Battery Test score of 85 or higher. Although we had recommended the elimination of this entire block of instructions, USAES requested that it be retained even if at a reduced scope.

c. Landmine Warfare: Deleted was the laying and recording of the minefield, but not the emplacement and removal of mines. A pioneer private in an engineer battalion does not supervise the laying and recording of a minefield. He is a mine carrier, a mine emplacer and a mine remover — these are still being emphasized, and he still receives all the instruction on a standard minefield pattern.

d. Field Fortifications: Eliminated was a practical exercise (PE) in construction of heavy timber

cut-and-cover bunkers. Instead, a series of static displays teaches the complete concept. The time was increased on wire obstacles and wire ties because experience has shown that the majority of trainees have difficulty in this area. Anti-vehicular obstacle construction was also eliminated and will be replaced with static displays.

e. Roads and Airfields: An excessively long PE has been reduced. Unit team work is stressed as well as individual effort.

f. Demolitions: Repetitious classroom material has been deleted. Safety standards have not been reduced. Each man still detonates three charges.

g. Rigging: Formulas not essential to MOS 12A10 were removed. The PE in construction of lifting devices was reduced as was the time spent touring the static site.

h. Squad Tactics: Eliminated review of all the items taught in basic combat training. Emphasized reorganization of the engineer squad as infantry, combat formations, control, movement, engineer reconnaissance and ambush patrolling. Also, defensive positions, range cards and supporting fire will be taught during a night bivouac problem. Eliminated daylight and night firing on squad defense range.

i. Non-standard Bridges: The complete bridge instruction remains. Eliminated reinforcement and replacement of the center section of simulated destroyed bridges. A static display easily shows how the same procedures used earlier in construction of the non-standard bridge apply and that repair is just a repetition of what was already learned.



j. Panel Bridges: Eliminated jacking down of the bridge on the far shore and removal of the launching nose. All procedures are taught on the near shore which would otherwise have been repeated on the far shore.

k. River Crossing Operations: The bridge committee evaluating this training recommended that the 27 hours be reduced to 16 to eliminate repetition. During the staff visit to Fort Belvoir, it was requested that it be further reduced to 8 hours and that the M4T6 float bridge PE be eliminated.

Added to the program of instruction upon recommendation of the Department of Doctrine and Training Development at Fort Belvoir were 3 hours of communications and 5 hours of map reading and land navigation, which are no longer taught in BCT but are required knowledge for mobile combat engineers.

After the program had been reduced to four weeks with an opportunity for the highly motivated and better educated to complete it in only three weeks, it was time to develop the next two ingredients that commanders want in a combat engineer — motivation and confidence of his ability to learn.

DEVELOPMENT OF MODULES

Modules were developed, lasting 1, 2, and 3 weeks in duration, in the 3d, 4th, and 5th Battalions of the 4th Advanced Individual Training Brigade (Engineer). These modules included:

- Crane
- Wheeled tractor

- Quarry operator
- Light vehicle driver
- Material Handling Equipment (Forklifts)
- General Construction Machine Operator
- Grader
- Asphalt Plant Operator
- Electrician
- Plumber
- Water Supply
- Demolitions

The personnel who completed the course in 3 weeks (by working Saturdays) were given first choice of modules for follow-up training. After completion of the proficiency test during the 4th week, the rest of the company was ranked according to test results and overall performance. The man who was the best achiever got first choice of modules. Since there were a limited number of vacancies in each module, motivation to excel was extremely high during the combat engineer training. The men were reluctant to miss a class because it could affect their standing. Barracks orderlies were rotated at noon. Sick call was about one-third the normal rate.

Indicator statistics for the two test companies in the 1st Battalion reveal that motivation of trainees was achieved.

PROFICIENCY TEST

The Proficiency Test administered was the same one given to the graduates of the normal 7 week program. It was administered by the Director of Plans and Training at Fort Leonard Wood — the same personnel who administer the 7





week test. The 15 cycles immediately prior to the test program averaged from 30% to 58% maximum scores. Company A had 50.15% and Company C had 72.4% of their personnel who "maxed" the test.

The enthusiasm displayed by the trainees for this test program was captured on an Educational Television Video Tape with interviews of graduates who completed the course by modified self-paced instruction in 3 weeks.

Some of the Drill Sergeants and Pioneer Committee cadre were skeptical of the program initially. The trainees have completely changed all this by their attitude and motivation, which is far above what was experienced previously. Trainees indicate that the previous program had only taught them military skills. What they really want is a hard skill they can also use outside the Army. With this opportunity to obtain it, and win an additional MOS at the same time, most of the complaints previously registered about pioneer training were eliminated. Additional MOS's obtained during this test program were as crane operators, tractor operators, and water supply specialists. The same tests were administered as are given to their regular A.I.T. 7 or 8 week classes. The extreme motivation displayed by the pioneers in the module phase of this test program astounded the regular trainees as well as their cadre.

The pendulum is swinging. The name of the game is recruit, train and retain. The addition of this incentive training with the opportunity to learn hard skills will greatly assist in this goal. If

the pendulum should swing back to draft, train and ship to a combat zone, the standard program now in being can be quickly reestablished. It is just more repetition in the hope of establishing a finer edge to the combat sword. However, the modern volunteer Army must be flexible, challenging and incentive oriented.

It appears that the incentive program with the modified self-pace option for Pioneers will prove to be a huge success and will improve the caliber of the privates sent out as replacements for combat engineer battalions all over the world. The results are still being compiled and the final decision rests with TRADOC. However, the data so far appears to indicate clearly that this program will produce soldiers who understand the basics of combat engineering, know the school of the soldier, are motivated and are confident of their ability to learn any job or mission assigned to them related to their MOS.

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THE ENGINEER CENTER TEAM

ENGINEER STAFF

How many times have you said, "who came up with this idea, why aren't the Engineers talking to each other?" Or maybe you have wondered about such things as the possible use of Commercial Construction Equipment in Engineer units or the requirement for a boom on the CEV? Well, it may come as a surprise to you but the Engineers have been discussing subjects as these and other matters of mutual interest and doctrine for some-time. This was first accomplished at the Engineer Quarterly Conference and later, commencing in 1967, through the Engineer Center Team. Unlike the Quarterly Conference, which functioned primarily as a Senior Officer briefing, the Engineer Center Team emphasizes the pooling of expertise and experience and is a forum for the free exchange of ideas and opinions.

The Center Team was formally established by DA on 18 July 67 in recognition of its potential in strengthening Army doctrinal, educational and training programs. Adoption of the Center Team concept was directed for all service schools having counterpart combat development agencies.

The Engineer School delved further into this concept and the Engineer Center Team was officially formed with the signing of the Joint Coordinating Agreement on October 17, 1967. The Commandant, United States Army Engineer School, (Chairman), the Assistant Commandant, United States Engineer School, Director of Facilities Engineering, OEC, and the Commanding Officer of the United States Army Mobility Equipment Research and Development Center, the President, United States Army Armor-Engineer Board, and the Director, Defense Mapping School are dedicated to the resolution of issues on matters of Engineer interest. In addition to these members, the Commanding General of the United States Army Training Center and Fort Leonard Wood, as well as the Chief, Engineer Division, United States Army Armor Engineer Board are invited to participate or send representatives. The team is not meant to replace routine day to day coordination but is concerned with

expediting matters of Engineer interest that support the Army in the accomplishment of its mission. The Engineer Center Team meets the last Thursday of each month with the mission to surface problems and conflicts in areas of Engineer interest. This means that the Center Team works together to arrive at a consensus agreement prior to addressing issues with their respective commands. This effort shows that Engineer matters are being resolved by Engineers.

The inner workings of the Engineer Center Team are not complicated. A Standing Coordinating Committee, made up of junior representatives, strives to expedite resolution of problems at the working level prior to the Center Team meeting. The Standing Coordinating Committee also selects the agenda topics and arranges for presentations by knowledgeable persons.

Since its conception, the Engineer Center Team has discussed a wide variety of topics from pollution control to personnel management. Some of the topics which have been discussed include: Commercial Construction Equipment, Countersurveillance and Camouflage, Geographic Intelligence and Topographic Support System for the Army in the Field — 1975 (GIANT-75) and the Construction Battalion Evaluation, which was a topic in the January, 1971 edition of THE ENGINEER magazine. The Engineer Center Team has also been one of the leading exponents in the exchange of minutes between Center Teams in order to bring about a more efficient overall approach to Army-wide problems and strives to provide a greater impact on methods for solving problems.

Some of the items to be discussed in the future will include: Engineer Support of other services, Combat Engineer Systems Program Review (CESPR), Engineers fighting as Infantry and Individual Unit Training.

So the next time you ask yourself, "who came up with this idea?" There is a good chance it was discussed within the Engineer Center Team one Thursday morning.



LTC Joachim K. W. Zickert

PARTNERSHIP -the German Army Engineers

Working for freedom is a never ending job which requires a united effort of all nations. Such is the role assumed by the North Atlantic Treaty Organization (NATO) nations. But what of these allies? What do they share in common or work to achieve together? A closer look at one of these partners will perhaps imbue a greater understanding of the similarities and differences which exist.

Picture yourself on a bridge site along the Rhine River in Germany. American and German army engineers are constructing a floating bridge. In the mountains, another joint training exercise becomes a mission accomplished. After duty in a US Army club or in a German gasthaus, American and German soldiers are enjoying a beer to celebrate the days achievements. These are just a

few of the many faces of partnership.

In the years of this partnership, units of both American armies have participated together in training exercises, athletic contests, social events, and have worked together as "sister" units. These units conduct annual maneuvers to monitor and test unit training and readiness as integrated armies under the NATO command. As soldiers of NATO they have discovered how much they have in common as citizens of allied nations of the free world.

But what does the German Army and the German Corps of Engineers look like and how are they organized? Since Germany makes the largest contribution of all the allied nations to the ground forces of NATO, let's take a look.

THE GERMAN ARMY

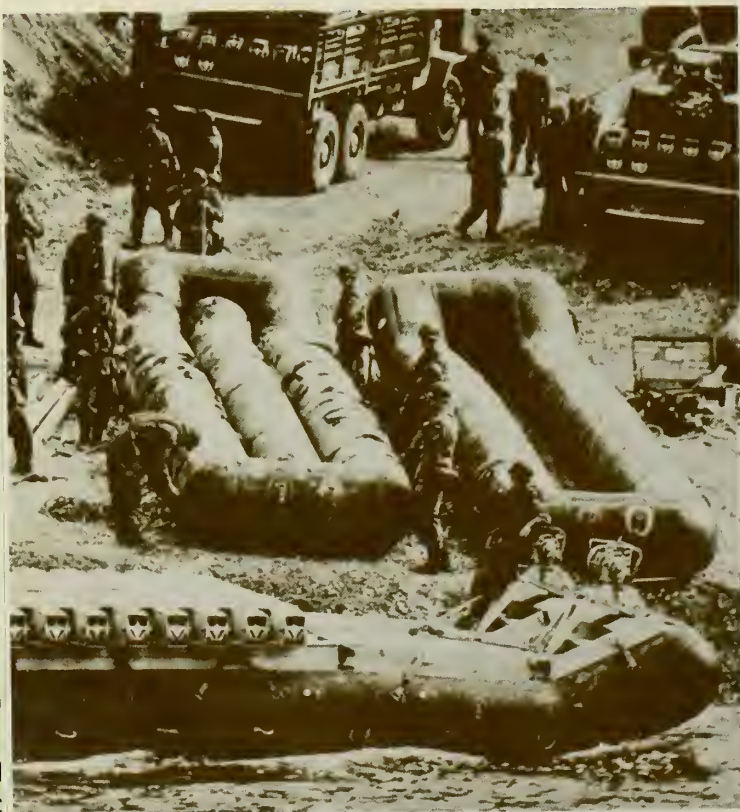
The Bundeswehr of Federal Defense Forces totals more than 460,000 men. The Army itself numbers over 350,000 troops and is the largest component of the Bundeswehr. The Army's 350,000 men are divided into three corps in which there are 12 divisions; four mechanized infantry, four armored, two light infantry, one mountain division, and one airborne division. Each division is further broken down into three brigades (and special troops) organized into battalions and companies. Some examples of these organizations are:

- A Mechanized Infantry Division (PANZER-GRENADIER) made up of two mechanized infantry brigades and one armored brigade.

- An Armored Division (PANZER) made up of two armored brigades and one mechanized infantry brigade.

- A Light Infantry Division (JAGER) made up of two light infantry brigades and one mechanized infantry brigade. As a combined arms units, each brigade is self-sustaining and capable of fighting on its own for a limited time.

- Brigades. There are four types of brigades. Each is organized differently and tailored to a specific mission. For example, an armored infantry brigade consists of three armored infantry battalions and one armored battalion. Each brigade has their own artillery battalions, one support battalion, one armored engineer company, and special troops of company-size.



THE GERMAN CORPS OF ENGINEERS

The Chief of Engineers and his staff are a part of the Army General Office which is a subcommand of the Chief of Army. Civil works such as flood control and other missions of this type are not provided by the army engineers. They are matters of other government installations.

The active Corps of Engineers has a total strength of:

- 29 battalions
- 7 battalions partly activated
- 43 separate companies

The mission of the German Engineers is briefly as follows:

- Facilitate the movements of friendly troops
- Impede the movements of the enemy
- Raise the combat capability of friendly troops
- Reduce the combat capability of the enemy
- Support the service troops in logistic tasks
- Be responsible for damage control
- Fight as infantry in self defense and in critical situations.

To accomplish the above, the German Engineers are organized as follows:

Armored Engineer Companies are organic to



the different types of brigades. Their mission is to support the combat arms in their combat tasks. These companies consist of:

- a company headquarters squad
- three armored engineer platoons with three squads each
- one AVLB platoon (5 AVLBs)
- one heavy equipment and ammunition platoon
- one maintenance platoon

Engineer Battalion (divisional) are division combat support troops. The division Engineer battalion consists of:

- one headquarters support and maintenance company
- three combat engineer companies (the third engineer company is a basic training company during peacetime)
- one heavy equipment and brigade company.

The battalion commander is also the division engineer.

Engineer Battalion (heavy equipped) are corps combat support troops under the direct command of Corps Headquarters. The battalion consists of:

- a headquarters company
- 3 combat engineer companies
- 1 heavy equipment company

This type of engineer battalion contains more and heavier construction equipment than any other type of battalion but is not a construction battalion.

Engineer Battalion (light equipped) another battalion on corps level has:

- one headquarters company
- three combat engineer companies — (primarily designated for barrier missions)

Mobile Assault Bridge Battalion also belongs to the family of corps troops and consists of:

- a headquarters company
- three mobile assault bridge companies

Each bridge company is equipped with 18 M2-B amphibious bridge and crossing vehicles.

Float Bridge Battalion and Separate Companies.

- 1 headquarters company
- 3 float bridge companies (equipped with the hollow deck bridge MLC 60.)

River Ferry Company consists of 9 river ferries and 3 patrol boats.

Specialized Engineers are organized according to their mission tasks. Examples are as follows:

- Pipeline Battalions and separate companies
- Railroad Companies
- Technical Companies for electric power and water supply.

Another Engineer organization as a part of the Territorial Army are the special barrier teams (Wallmeister). They are attached to the Military districts and their mission is to build and maintain fixed barriers for all NATO troops in Germany.

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CONSTRUCTION MANAGEMENT

CPT Lamar C. Ratcliffe, Jr.

The United States Army Engineer School at Fort Belvoir, Virginia, instructs officers and non-commissioned officers in many subject areas that they can expect to see and use in their military careers. One important subject which sometimes does not receive proper student attention is construction management. This lack of student interest is probably due primarily to one of two factors: the students either consider construction management techniques to be "common sense ideas that are obvious" or question whether or not they are applicable to the military environment.

The author cannot argue the first point because he also believes construction management to be based upon common sense; however, he knows from his personal experience that construction

management techniques can be used with great effectiveness on large military troop construction projects. The construction of the heliport facility at Camp Carroll Depot, Korea, demonstrates the proper application of the construction management techniques taught at the Engineer School.

In July 1973, the 802d Engineer Battalion (Construction) received advance notice that it would soon have the mission of constructing a heliport at Camp Carroll Depot. Upon receiving the job directive, the battalion commander and his operations officer visited Camp Carroll Depot to investigate the proposed site for the heliport and complete the preliminary planning. They reviewed the plans and the construction specifications with the commander of Company D and made some



AT WORK

rough estimates of the types and quantities of construction effort required. They quickly determined that the project would include the displacement and subsequent compaction of 100,000 cubic yards of earth fill, construction of a 70 ft wide, 450 ft long runway, placement of three 45 ft by 75 ft concrete parking pads and installation of a 370 ft long underground drainage system. The company commander was confident that his company could handle the entire project if it received additional earthmoving equipment. Based upon the initial calculations and his company commander's confidence, the battalion commander assigned the heliport project to Company D and promised that additional equipment would be provided if required.

Upon receiving his company commander's guidance, the company construction officer developed a detailed plan for the project. He analyzed the scope of work of the project, determined the activities to be accomplished and developed a detailed cost work estimate of the required man-hours, equipment hours and materiel for each activity. Next he used the critical path method (CPM) to determine the critical activities and the required delivery date for each construction material. From his critical path analysis, he scheduled the entire project and obtained the estimated completion date. He also determined that compaction of the earth fill was the critical factor and that the company would need additional compaction equipment to maximize earthmoving efficiency.

While the detailed planning was being completed, the company commander mobilized his available men and equipment resources. First the earthmoving platoon prepared the site for the installation of support facilities and set up a general purpose (GP) medium tent for messing operations. Next the first general construction platoon erected a portacamp to be used as the project office and first aid station. Simultaneously the maintenance section set up a maintenance tent to provide a covered facility for support maintenance. Mobilization was completed when two sheepsfoot rollers, two bulldozers and three 290M wheeled tractors were provided to solve the compaction problem.

When the actual construction began on 4 September 1973, the company commander used directives and control measures to supervise his project. He directed his platoon sergeants to submit daily progress reports which detailed the work accomplished, the construction effort actually required and the materiel used. The company operations sergeant compiled the information from these reports and maintained complete records for the project. He also monitored the expected delivery date and the receipt of each construction material; he informed the company construction officer when materiel problems occurred. From the daily progress reports and the materiel status reports, the construction officer updated his CPM schedule three times a week. This updating gave him a graphic representation of potential problem areas in sufficient time for him to reallocate the available men and equipment resources and thus minimize delay of the estimated completion date. To insure that quality construction was being accomplished safely and efficiently, both the company commander and his construction officer made daily inspections of the project site and made on-the-spot corrections. The end result was a quality construction project which was completed on time.

Management of the heliport construction at Camp Carroll Depot included preliminary planning, detailed planning, site preparation and proper supervision. All four techniques are taught at the Engineer School. Admittedly, they are common sense techniques. In addition, as you have seen, they are applicable to the military environment. The proper use of these construction management techniques resulted in the quality construction of the Camp Carroll Depot heliport.

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THE HENRY LARCOM ABBOT AWARD



Membrane-Encapsulated Soil Layers

Captain Gordon T. Greeby, Jr.

Men, money, materials, and time — the efficient utilization of these resources is construction management in its purest form. We in the military have not always used our given resources in the most efficient manner. True, time must govern all when constructing in a tactical situation. Un-



fortunately, our preoccupation with construction speed carried over into peacetime operations with crew size, materials used, and money spent relegated to secondary roles.

Our civilian counterparts in the construction industry learned long ago that time is *not* the governing resource. With a large percentage of our labor force engaged in construction, it goes without saying that construction has become big business. And which of the four major resources reigns supreme in any big business? The omnipotent dollar has been crowned the new king.

Today, military construction is big business also. Not surprisingly, the dollar has "muscle in" on time as the governing resource. As Corps of Engineers officers, we are tasked with constructing with fewer men, less materials, and at lower costs. And as one might expect, we have found that in many cases the optimization of the use of men, money, and materials has resulted in shorter project durations.

How has the Corps of Engineers responded to the need for a better product at minimum cost? The development of new military road building techniques is only one of many areas in which progress is being made. Specifically, the U. S. Army Waterways Experiment Station, Vicksburg, Mississippi, has developed construction methods and procedures for the use of membrane-encap-

sulated soil layers in military road construction. The utilization of membrane-encapsulated soil layers will reportedly speed up road and airfield construction at decreased costs. A more palatable blend of resource utilization cannot be imagined.

Since the 1940's, the Corps of Engineers has employed the California Bearing Ratio (CBR) Method of designing flexible pavement structures. Basically, the CBR value of a soil is a comparative measure of that soil's resistance to failure by shear. The CBR of design combines the results of a load-deformation test with an empirical design chart to determine the thickness of pavement structure layers.

Although nineteen of our fifty states use this method with its numerous variations for design of their asphalt pavement structures, the CBR Method is not immune to criticism. Proponents of other design methods have attacked the CBR Method on two counts. First, it is said that penetration of a piston into a confined soil specimen does not simulate the shear stresses which actually develop in similar soil under a flexible pavement. Second, the soaking of specimens for four days prior to testing is not representative of actual field conditions in most cases. Generally, wet soils yield lower CBR values when tested than when dry. Low CBR values dictate large overburden thicknesses for adequate



stress distribution, as indicated by the empirical design charts. The requirement for large pavement structure thicknesses usually points to high construction and material costs.

Up until this time, it has been customary procedure to select pavement structure materials with high CBR values, i.e., not adversely affected by water. Materials commonly used for this purpose are crushed rock, granular materials from natural deposits, and stabilized in-place soils. However, it is not uncommon to find that such materials do not exist on or near the project site. As such, much time and construction effort must be expended at great cost in obtaining such materials.

The Experiment Station at Vicksburg has demonstrated that in lieu of granular materials, membrane envelopment of *fine-grained* soils can be utilized as the base courses for flexible pavements. It is known that high density fine-grained soils exhibit high strengths if kept dry. The availability of such soils poses no problem — they may be used from cut sections at the construction site. But keeping them dry is another matter. Numerous types of membranes were tested; and although the results of these tests have not been finalized, it appears that a 6 mil-thick polyethylene lower membrane (\$0.07/SY), when used in conjunction with a nonwoven polypropylene upper mem-

brane (\$0.35/SY), will prove to be the most feasible.

As dry fine-grained soils yield high CBR values, required base course thicknesses are minimal. Traffic tests have shown that a 12-inch lift of soil, when compacted to 95% of AASHTO T-180 Method B density will easily support 5-ton dump truck operations for extended periods of time. It can be seen that the use of membrane-encapsulated soil layers represents an economical, as well as rapid, means of constructing military roads in the Theater of Operations.

Today, more than ever before, we as Corps of Engineer officers must be alert to the proper and efficient management of those precious resources with which we have been entrusted — specifically, that omnipotent dollar.

Captain Gordon T. Greeby, Jr., is presently assigned as a student in the Engineer Officer Advanced Course, Fort Belvoir, Virginia. He commanded D Company, 249th Engineer Battalion (Const), in Germany, and served as a project officer with the Eighth Army Engineer in Korea. After receiving a BS degree in 1968 from the United States Military Academy, he received a MSCE degree in Soil Mechanics and Foundations Engineering and a MSCE degree in Construction Management, both from Stanford University.

Major Charles Gardner



TRAINING — The Elusive Commodity

The air is hot and stuffy in the smoke filled company classroom as a crusty combat engineer sergeant labors through yet another lesson on bridge demolitions. Two specialist four silently doze in the back row while a PFC and a specialist five engage in a homemade "wargame" near the front. The first sergeant has reported 25 men present for training. The soldiers shuffle restlessly in their seats as Captain Candid, the company commander, slips in the back door to "check training".

Sound familiar? Read on, Captain, because you are the Army's principal training manager.

Mission-oriented training and testing still receive low priority from engineer unit commanders. Training objectives are not being met in many cases. The reasons are clear and basic: (1) lack of a clear definition of training responsibilities and concepts, and (2) the failure of field elements to obtain, review, and use the military training publications now on the market.

This article attempts to focus on the role of the engineer company commander in training his unit, the concept of performance training, and specific sources of information to guide training activities. The development of the notions herein concerning training is based on the following concepts:

- Operations and training are synonymous and inseparable.

- The best training takes place in units.

- The company commander is responsible for the technical and tactical proficiency of his people.

Setting performance as the goal. The civilian and Army training and educational systems are committed to performance training. To know how is not enough. Today's soldier must be able to do. The literature producing people at United States Army Engineer School, Fort Belvoir, Va. (USAES) and other service schools are committed to producing literature on how to conduct performance training and testing. No matter how the system tries, however, it would appear that the Army continues to have a "packaging and marketing" problem, i.e., getting the right literature in the right quantities to the right person. Perhaps the problem in the field is that when one is inundated day after day with official literature of all sorts emanating from all sorts of sources, he becomes less able to skim off those publications primarily dealing with effective training. Some of the most highly effective publications are noted in this article.

It is necessary that all commanders understand what is meant by performance training. For example, suppose a platoon sergeant takes his platoon out for some demolitions training. He has each man in the platoon prime and detonate a quarter-pound block of TNT. Good performance training, right? **Wrong!** Should the commander now assume that the platoon can now emplace explosives for road craters or bridge demolition? About all he can reasonably expect is that each man can now prime and detonate a quarter-pound block of TNT.

Performance training requires some ingenuity. As a place to start, forget the classroom scene. Most soldiers get enough sleep at night. Performance training should occur in the field, but all training in the field cannot properly be described as performance training. If the training must take place outside of the normal operating environment, your approach is suspect. Use your head.

Get in the mood for performance-oriented training by absorbing some of the information in FM 21-6, *Military Training*, dated 1 June 1974. This manual is short, easy to read, and doesn't even look like an FM. Chapter 2 should put you on the track.

Before wasting a lot of time attempting to do all the work yourself, reach for instant relief in the form of the Army Training and Evaluation Program (ARTEP) 5-35 if you are in an Army Engineer Combat Battalion or 5-145 for the Mechanized Divisional Combat Battalion. In a pinch, use them interchangeably. ARTEP's for other engineer units are on the way. The ARTEP provides guidance for scheduling, conducting, supervising, and evaluating unit training. It provides an excellent "laundry list" for evaluating your current training proficiency as well as minimum training objectives in terms of acceptable degrees of proficiency and levels of performance.

Unit Training — the logical alternative. The Army is composed of a large number of individual skills molded into units with designated missions and capabilities. Since we function as a unit, why not train as a unit? Many direct and indirect advantages accrue from unit training. Once again the ARTEP is your handy one stop reference for guidance.

Soldiers report to a unit after completing AIT and developing a basic skill. At best these individuals are at the appropriate level and require practice and additional training to develop added proficiency. The Enlisted Personnel Management System (EPMS) now being structured will require that the unit develop the individual soldier's skills. EPMS is a review of the enlisted MOS structure to provide an improved skill and career progression for qualified enlisted personnel. This system will most likely get the company commander more involved with assisting the individuals in his unit in maintaining technical proficiency.

Unit training encourages total involvement of every member of the unit. Unit training develops leadership. It provides incentives for squad leaders, platoon sergeants, and platoon leaders to gain and maintain proficiency. It allows the commander to evaluate his subordinates in an objective manner.

Finally, unit training is cost effective. In reality, it is simply an efficient way to utilize the training time now available. It would seem reasonable to predict on the basis of past experience that military budget cuts during peacetime will take their toll on the Army's training base. One can reasonably expect a reduction in the number and length of school taught engineer courses at both Fort Belvoir and Leonard Wood. Troops must remain in a unit *and* maintain proficiency. Good performance-oriented, unit training is essential for future readiness.

Role of the engineer company commander. The primary mission of the company commander is to train his unit. His job and the complexity of his mission have changed very little. Many young

company commanders find themselves so enmeshed with administrative functions that the primary mission becomes obscured. This total involvement with administration is poor camouflage for what is likely a serious training deficiency. Mobilize and train those headquarters platoon elements, diversify the workload, and get back to the real mission. FM 25-2 (Test), *Unit Commander's Guide*, dated 29 March 1974 will help you to more efficiently accomplish your administrative functions. Try it!

Lack of adequate time for mission-oriented training continues to be a problem for most engineer units. An analysis of the situation will likely determine that the belief there is not time for training is a self-imposed constraint. Commanders must allocate time for training if they expect combat capability. Minor construction, area beautification, and nice-to-have projects generally do not constitute good training for most engineer units regardless of their political implications. These tasks must be accomplished but recognize their limited training value. Tasks should be performed in a manner which maintains unit integrity where possible. Clustering individuals rather than utilizing an existing squad is likely to be counterproductive from the training viewpoint. Accept these projects as part of the engineer mission and plan around them. Proper planning well in advance is the key. Develop your schedule for training. Block out reasonable periods for projects. Set deadlines and goals for both the training and the projects. Stick to the plan.

Once you have set your sites on a good unit training program, a key step is training analysis. Only the company commander can determine those areas in which a unit **really** needs extensive training. Chapter 2, FM 25-2, is helpful for general guidance; use the ARTEP for specific tasks to be trained. Once you have completed a training or testing cycle you have some notions as to the unit's proficiency.

Another item to support training now under development is the individual counterpart to the ARTEP called the Individual Training and Evaluation Program (ITEP). If approved this document would replace the Army Subject Schedule for each MOS. Both the ITEP's and ASubjSed's produced by USAES are quite detailed and carefully delineate what each soldier should know and be able to do. These documents are invaluable to the MOS holder and the unit commander in the analysis and development of a unit training program and should be a part of the unit's publications library.

There are some indicators of individual proficiency available. Consider the MOS test results for a moment. Each company commander should review and analyze the results reported on the USAEEC Form 10 and the summary profile

report. MOS tests are about proficiency, not just extra pay. Perhaps a composite of the MOS test scores for the NCO's and EM in a unit may really be a measure of the proficiency of the unit commander and his training program. Commanders must:

- Understand the purpose and importance of the MOS test.
- Insure that study guides are provided in a timely manner.
- Insure that all required study references are on hand or readily available.
- Provide a quiet area conducive to study.
- Make on-duty study time available.
- Show special interest in very low density MOS's and understand the problems inherent to these individuals.
- Counsel NCO's and EM on the importance and implications of MOS test results. Under EPMS the test results take on added importance.

Assembling a good company library which will adequately support unit and individual training is no small task and requires careful attention to detail, some ingenuity, and many hours of work. Hopefully, one is not starting from scratch. First, which manuals should be on hand? No simple answer here but some good sources for developing your own list are available. Consult the ARTEP and the study guides provided for each MOS in your unit.

Leadership is still the key. Two things are clear to this writer. Good training can occur only when properly planned and executed by an aware and dedicated company commander. Secondly, due to time limitations, the company commander needs knowledge of and ready access to a few key training publications to guide his activities. The trend towards the one-stop training guides and study references such as those mentioned in this article is a significant step forward for commanders in the field. Exercise your leadership abilities through proper training of your unit. Raise your sights and train for performance.

Major Charles E. Gardner is assigned to the Engineer School, Deputy Commandant for Combat and Training Developments. He received a BS from the United States Naval Academy and an MS in Civil Engineering from the University of Illinois. He is a graduate of the Command and General Staff College and a registered professional engineer. He has served with the 10th Engineer Battalion, 3d Infantry Division; MACV Advisory Teams; MACV Construction Directorate; Nuclear Cratering Group; and the Department of Engineering Science, USAES.

DOMESTIC ACTION

CPT Jeffrey A. Wagonhurst

The primary objective of the Domestic Action Program is to instill interaction between the civilian community and the military. If we were to look around our country, we would find that the needs of the civilian community are great. For various reasons it is not always possible for the civilian population to do the work that needs to be done to improve its community. For example, the community may not have the necessary equipment for certain projects, nor the money to purchase or rent the equipment. A shortage of people is also a problem, as it is difficult for working people to take time away from their jobs to participate in community projects. Another difficulty may be that the cost of these projects is too great for a small community to sustain.

The Army has the capabilities, the equipment, the time, and the personnel to apply to these situations. Our country is always one of the first to send aid and assistance to foreign countries in need. We can apply this system to our own smaller communities who are also in need of outside help. The Army is always looking for ways to make itself more intriguing and appetizing to the civilian population. What better way is there to do this than by helping the neighbors of its military installations throughout the United States.

Many soldiers complain that all they do is train and maintain equipment. As a result, they become discouraged and disenchanted with the Army. Participating in civilian community projects, such as constructing a park and recreation area or helping the community in a crisis situation, provides interest and stimulation for the young soldier. He is given the opportunity to meet and to work with people outside of the Army community, thus abandoning the feeling of separation. Also, he has the chance to leave the Army post and to see its surrounding countryside.

To show how interaction between the civilian and military communities can be a worthwhile endeavor, the success of a Domestic Action Project completed by a platoon of men from B Company, 20th Engineer Battalion (Combat), Fort Campbell, Kentucky will be discussed. The city of Cleveland, Tennessee, located approximately forty miles northeast of Chattanooga, was planning to con-

struct a county recreation area consisting of various athletic fields and picnic areas for the people of the community. The Chamber of Commerce realized that they did not have the heavy equipment necessary to do the earthwork for the project. The construction companies in the area were very busy with other important contracts and county work, and they could not release any equipment to do the job. Mr. John Tyler of the Cleveland Chamber of Commerce decided to write to the Commanding General at Fort Campbell to ask for assistance in completing the earthwork for their recreation area. When the Commanding General received the letter, it was forwarded to the C-5 of the installation for evaluation. The C-5 made contact with the Operations Officer of the 20th Engineer Battalion to request that a reconnaissance of the project in Cleveland, Tennessee be made by personnel from the Battalion. An initial recon of the project was made in the spring of 1973, and the project was evaluated by the C-5 based on the information from the initial recon. The project was assigned to the 20th Engineer Battalion (Combat), and the Operations Officer of the Battalion further assigned the project to B Company. In August, the company commander and the project officer flew by helicopter to Cleveland, Tennessee to make a final estimate of the project. After a discussion with personnel from the Cleveland Chamber of Commerce, the dates for the project were set for 1 through 15 October 1973. On 1 October 1973, a platoon, under the command of Lieutenant Sheldon L. Jahn, departed from Fort Campbell, Kentucky for Cleveland, Tennessee. Upon arrival in Cleveland, the platoon was met by Mr. John Tyler of the Chamber of Commerce. After the platoon unloaded their heavy equipment, Mr. Tyler took the men to the motel where they would be living for the next two weeks. The accommodations provided for the men were very pleasant, as each man had a doubled bed to himself and a color television set in each room. The men ate their meals in the motel restaurant where they could order what they wanted. All accommodations were provided at the expense of the city of Cleveland.

Work began early on the morning of 2 October, and it was continued everyday for the following

two weeks. The initial task accomplished was the upgrading of the existing drainage by clearing and rerouting the natural stream channel at the project site. An access road to the rear area of the site was cut by removing the top soil, and then it was graded to the approximate grade. Drainage ditches were cut along the length of the access road and tied in with the natural stream. A borrow pit was then upgraded, and the material was stockpiled at a local farmer's farm. This material was hauled to the project site and used to fill around two culverts placed in the stream channel. The two culverts allowed access to the project parking area. Fill was then hauled to this area, and a parking lot 70 x 120 feet square was filled and leveled. At the same time the fill was being hauled in, the first of two Little League baseball fields was being cut and filled to grade. The second Little League field was then cut to grade while the first was smoothed and drainage around the field was established. A third softball field was then cut to grade while the second field was smoothed and the drainage was established. The first two fields measured 160 x 160 feet square each, and the third field measured 320 x 320 feet square. All roads and fields were then regraded, included the existing loop around the grade school which was adjacent to the project site. Separate drainage ditches were cut to aid in draining the open field of the recreation area. The borrow pit site was cleaned up, and the access road to the pit was smoothed. Approximately 15,000 cubic yards of soil were moved during the project. A total of 2,773 man hours and 2,241 equipment hours were expended on the project. The project was completed on 15 October 1973, and the unit returned to Fort Campbell, Kentucky. The lessons learned from the project were very beneficial, and the men got to operate their equipment which contributed a valuable resource to the community.

On any domestic action project conducted by the Army, it is strongly recommended that arrangements are made for some kind of recruiting drive. The 20th Engineer Battalion used several methods in its recruitment efforts. A trailer which displayed pictures and posters about the unit itself and of the opportunities offered by the Army was parked next to the project site. The local newspaper, the *Cleveland Daily Banner*, was contacted upon arrival, and it gave the unit complete support by printing articles with pictures concerning the project. A Chattanooga television station came to the project site and filmed a short news clip which was shown on the local news. However, most important of these efforts in establishing rapport between the civilian and the military communities and in encouraging enlistment was the close, eyeball to eyeball contact the civilian community



received by working hand in hand with the Army.

The Viet Nam war left an uneasy feeling in this country towards the military. Using the Domestic Action Program as a tool, the Army can change the feelings of the civilian communities to that of respect and understanding of the military. Not only will the Army benefit from community relations; they will also be rewarded in that the soldiers will become well trained with their equipment, and they will feel that they are actually taking part in a job that contributes to the country. The Domestic Action Program is necessary to both the Army and the civilian population in order for the people of this country to live and work together as one community.

Captain Jeffrey A. Wagonhurst is presently a member of the Engineer Office Advanced Course at Fort Belvoir, Virginia. He was the Commanding Officer of B Company, 20th Engineer Battalion, Fort Campbell, during the project at Cleveland, Tenn. CPT Wagonhurst also served as the Asst. Group Operations Officer of the 34th Engineer Group in Vietnam.

Although the preceding article may be a few months old, it is typical of the many military engineer projects being done under the Domestic Action Program. We would like to share your experiences with our readers. Please drop us a line.

— The Editors

GEODESIC DOMES

John H. Robertus, CAPT, USMC

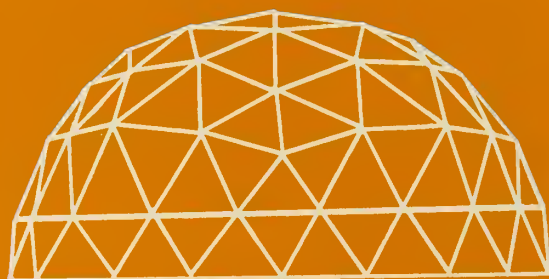
Nature has provided the examples that enabled man to take tremendous steps forward in his engineering quests using domes and arches. The simple stone arch was discovered to be a remarkable device and has offered important construction and engineering advantages to civil and military engineers for centuries. Arch type construction is commonly seen in Quonset huts and larger arched hangers and field houses which are everpresent on most of our military installations today. However, geodesic domes are not as widely accepted as the simple arch. But they should be!

A dome is actually an arch that extends into a circular base instead of the conventional rectangular base of the simple arch. The geodesic dome, if properly understood, is very simple, strong and lightweight. For theater of operation construction, strength and weight are important considerations. Once a geodesic dome is constructed, it requires no intermediate supports and it can be partially disassembled or repaired without collapsing. The structural members, known as struts can be made of wood, pipe, or other suitable rigid material. The struts are fastened together at their ends to form a triangular network that curves into a domelike shape when completed. The particular triangular network desired can be derived with spherical geometry. Two methods are pictured:

The finished dome network can be covered with a variety of materials ranging from temporary tentage to more permanent steel reinforced concrete.

Domes can withstand wind, rain, and extreme temperatures if properly constructed. The United States DEW line system in North America has utilized geodesic domes to house delicate equipment for almost two decades. The Navy has recently constructed large domes in Anarctica to protect men and equipment working in that region. Domes in these environments have withstood extremely cold temperatures and winds up to 220 miles per hour!

With all the facts known about geodesic domes, the current T/O structures should be revised to consider this tested and proven system. The Quonset hut has definitely been a boom to military construction, but its parts must be prefabricated and transported to the erection site dismantled. Then, if all the factory parts are on hand, it can be assembled. Throughout the current inventory of metal structures this is a problem. A metal geodesic structure would have the same problem, except that a dome can be airlifted after assembly from a central location without damaging the structure. This theory has been considered by the Marine Corps for assaults from helicopter landing



"3-WAY GRID" METHOD



"LAMELLA" METHOD

ships and subsequent movements inland.

The geodesic dome has four other important advantages that must be carefully examined:

First. A given volume can be enclosed with less surface area using a sphere, than with any other shaped surface; this provides far more space for dollar spent for exterior surfacing.

Second. A dome structure transmits loading through compression and tension evenly along the surface to the base; this allows for lighter materials in the structure and a simple foundation design.

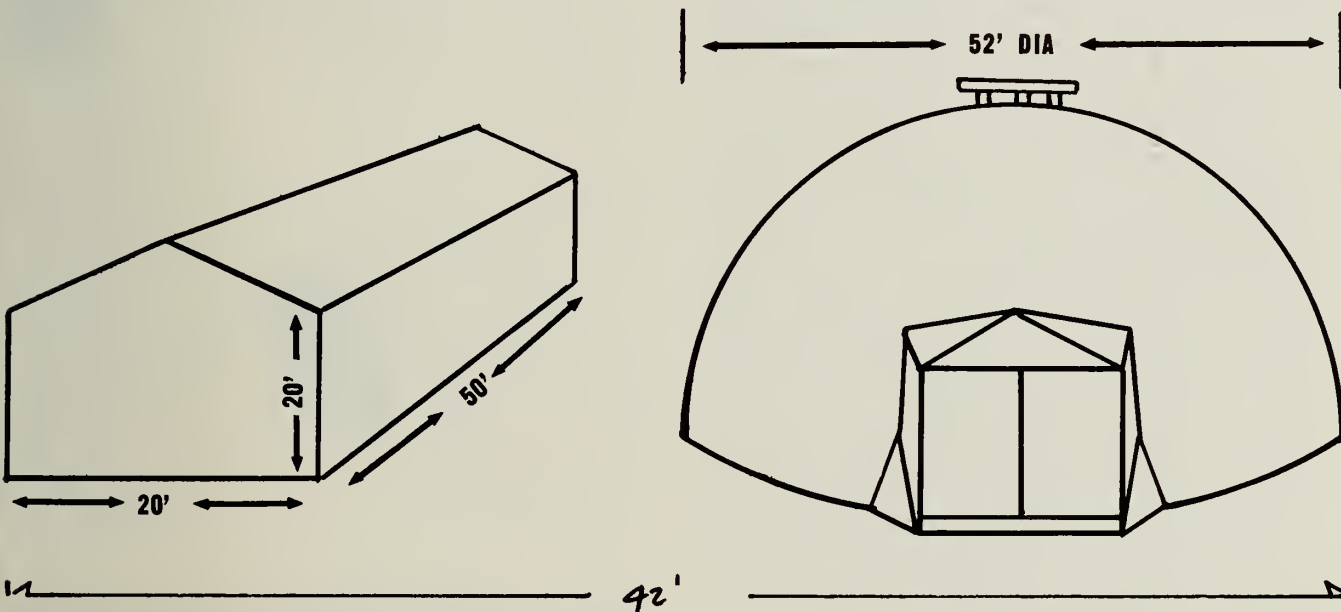
Third. A dome can be constructed from small modular components enabling unskilled workmen to quickly accomplish the construction without heavy equipment.

Fourth. A dome affords ideal air circulation and is compatible to centrally located utilities.

Consider the following comparison of a conventional structure and a geodesic dome:

shape can be altered to meet a variety of requirements such as vertical sidewalls or multi-level storage areas within the structure. The possible configuration of domes or clusters of domes are endless, and all such structures would posses the same basic advantages. The future should see widespread use of domes in the theater of operations construction. Overall considerations of economy, strength, and ease of construction make the geodesic dome design a potentially limitless tool for the military engineer.

There are many wonders of nature that have been tapped for mankind's use. The geodesic dome is simply an extension of the natural forces that enable a soap bubble or an egg shell to keep its shape. Certainly the marvel of the geodesic dome has yet to be fully appreciated. While architects and city planners are envisioning domes to cover out modern cities, our military planners should consider domes for our modern forces in the field.



CONVENTIONAL		DOME
4,100 Square Feet	Exterior Surface Area	4,100 Square Feet
1,000 Square Feet	Interior Floor Space	2,100 Square Feet
22,400 Cubic Feet	Interior Volume	36,000 Cubic Feet

Note that with equal amounts of exterior surface material, a 100% larger floor area and a 60% larger volume can be obtained with a dome system. Research indicates that domes exhibit excellent resistance to both air blast or ground shock waves if buried. A geodesic dome ferro-cement bunker may be a possible application for smaller domes. Domes are practical and feasible but may seem to waste space due to the curved shape, however this

Captain John H. Robertus is a 1968 graduate of the University of California, at Riverside with a B.A. Degree in Physics. He was commissioned in the Marine Corps in Nov 68 at Quantico, VA and received his military engineer training at Camp LeJeune, NC. He was then assigned to the 11th Engineer Battalion on Okinawa. After two years as an instructor/troop leader in the Second Infantry Training Regiment, Camp Pendleton, California he attended Engineer Officer Advanced Course 1-73 at Fort Belvoir, VA. Upon completion he was assigned as an instructor in the Department of Engineer Science, Structures Branch, USAES where he is presently stationed.

Have you ever had a need for light and lots of it? Well the men of the 2d Infantry Division stationed along the DMZ of Korea, "Freedom's Frontier", have learned the value of a good light bulb many times over. The troops had the mission of preventing infiltration by the North Koreans along a 24 KM sector of the Korean DMZ. The accomplishment of this mission was thwarted by rough hilly terrain, bitter cold winters, monsoons, vegetation and personnel shortages. On the positive side was the idea that good fences make good neighbors and the 2d Division had a good fence. The structure, called the Barrier Fence, was six feet high chain link, with three rows of concertina wire along the top. The only problem with the fence was that it was useless unless someone watched it and that is where the 2d Division had difficulty. Guarding the fence in daylight was relatively easy as the sentries could sit on ridge tops and observe in any direction. But at night things were different. The guards now had to be doubled and unlike the daytime, when a sentry had good observation and felt secure, the soldier was alone with the night and its sounds. Besides, sitting in a foxhole looking at a fence all night in some of the world's worst weather does not raise the re-enlistment rate. Many soldiers took up the dubious hobby of counting the holes in the fence; the record was 523,285. When the troops on night duty began putting in 18 to 20 hours a day, 7 days a week, the sense of mission began to stretch thin.

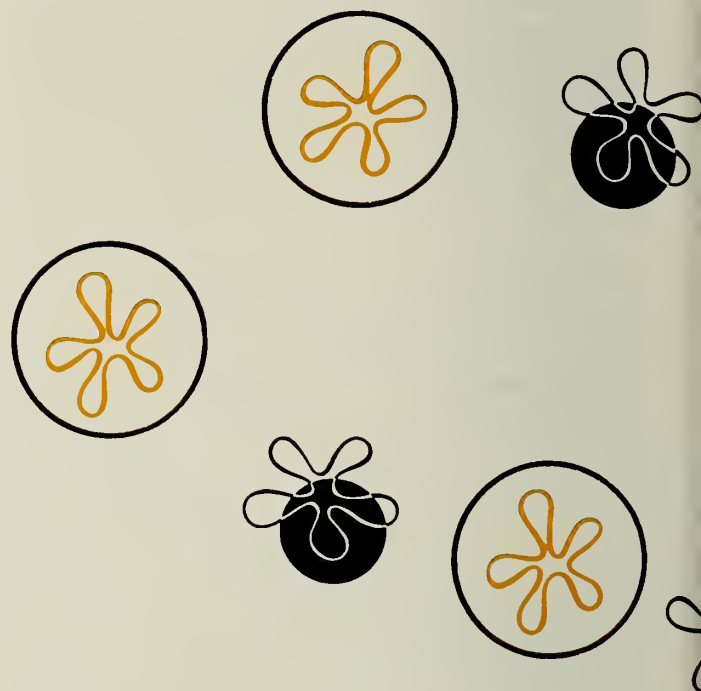
Things finally came to a peak when the North Koreans infiltrated the American sector for 2 surprise raids by actually cutting through the Barrier Fence without being detected. To help the 2d Division, Night Vision Laboratory (NVL) was asked to provide a lighting system for the fence.

In response to the Army's request, NVL agreed to design a remote Area Lighting System (RALS). After an on site inspection and an agreement on the design requirements, a proposal was submitted by Luke Burkstrom, MVL design engineer. His design was accepted and through competitive bidding a contract was awarded to the VARO Corporation of Texas. Tests of the system were conducted and VARO was soon in Korea ready for the installation. Speed was to be a real plus on this project.

VARL's arrival in Korea consisted of one man, Al Hussong. Mr. Hussong recruited a ten man Korean crew and soon had the first RALS in operation. With his speed crew and despite a late monsoon season, all nineteen systems were quickly in operation within eleven months from the time of initial request.

The RALS makes one claim that has earned it the engineer's everlasting gratitude; it is **simple**. Simple to install, simple to operate, simple to

Lighting Free



maintain, and simple to understand. When you are the only engineer in an infantry brigade with eight lighting systems, simplicity is very high on your priority list.

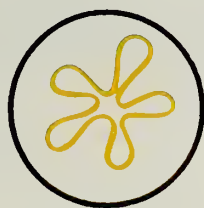
The RALS system consists of the following six major parts: Two standard 10 KW generators, one of which is used for backup; three kw constant current regulators from the US Air Force, to insure long bulb life and to prevent overloading of the generators; one hundred and thirty-eight 12 volt, 35 watt sealed beam headlights, the same as those found in a car using a 12 volt system; one hundred thirty-eight 6.6 amp transformers to isolate each lamp of the series circuit; one hundred forty-seven connector kits to insure weather-tight wire splices; and 15,000 feet, 8 gage stranded wire.

With the lights spaced 30 feet apart, one RALS provided light for 1.26 km of front. Each system



om's Frontiers

CPT Larry L. Austin



has three circuits, each controlled by a constant current regulator. Each of these circuits has 46 lights connected to 46 isolation transformers. So if a problem does develop, it is automatically narrowed to a section of 46 lights.

The design requirements of the system include recognizing an intruder at up to 50 meters with the unaided eye, denying an intruder the ability to see a sentry who is more than 15 meters behind the lights, providing a backscattering of light to aid the sentries in movement and unaided maintenance by the using units.

In the systems first six months of use, it successfully met those requirements. Any intruder that could normally be detected in daylight was also detectable at night within the 50 meter range, even with bad weather and poor terrain, the exception being heavy fog. In addition, light from the system greatly aided night vision devices

beyond the 50 meters. Any intruder approaching the fence had to look into a continuous row of headlights, completely denying him observation of the sentries behind the fence. In fact, it was impossible to detect a sentry who was standing directly behind the fence, mid-way between the lights, not a recommended practice for sentries. The reflection of light from the fence made the sentries movement over rough terrain much easier. Once the system was installed, operation and maintenance was performed by the Infantry Battalion stationed on the DMZ. Complete instruction on the system was given to personnel from the battalion in less than one hour including demonstrations on start up and shut down procedures, changing of bulbs, splicing wire, and trouble shooting. The US Army does have a draft TM, DTM 11-5840-351-14, dated February 1971, that gives detailed instruction in installation, operation, organizational maintenance, DS and GS support, shipping data and any other information a using unit would need to know.

Probably the greatest asset of the system to the unit commander is its flexibility. Each light in the system has the ability to be individually aimed both in the horizontal and in the vertical directions. Also the spacing of the lights is up to the installing unit. Many times lights were spaced 15 feet apart to light a ravine or ditch. Modification after installation is also possible, but care must be taken not to add too many lights and overload a circuit.

Even with this simply system, two problems developed. One was the operation and maintenance of the generators and the second was the daily changing of burnt out bulbs. Command concern quickly solved both of those problems. In the first six months of operation, two transformers went out. In both cases the cause was found and replacement made in less than an hour. Later, one of the main circuit wires was, accidentally, shot out. This repair required about ten minutes and a spare connector kit.

The RALS was not the final answer to problems in the 2d Infantry Division's anti-infiltration mission in Korea, but was a step toward success. The night sentry could now see to his front and sides, thus making him feel he was a part of a team with help always close at hand. Officers and NCO's moving up and down the fence checking the men found movement easy, with the back-scattered light, and the number of firing incidents by nervous sentries was greatly reduced.

To the men of the 2d Infantry Division standing their lonely vigil on Freedom's Frontier, the RALS has helped make a difficult task a little easier.

Captain Larry L. Austin is a graduate of the 2-73 Engineer Officer Advanced Course.



CPT Cecil Greene

When a cartoonist wants to depict a soldier in a funny situation, he often draws a picture of a GI digging a hole in the ground. But the holes now being dug in the ground at the Modern Army Selected Systems Test, Evaluation and Review (MASSTER) are a very serious business. These holes may help other soldiers protect themselves better on future battlefields. The holes and structures are all part of a test being conducted at MASSTER to examine new types of underground bunkers and protective shelters.

There is nothing really new about the requirement for different types of field fortifications. In all previous wars, field fortifications have been emplaced as a necessity by the people and

equipment available. Usually, these fortifications are very hastily built and not necessarily structurally sound for they are often constructed for immediate protection only and then abandoned. The need for the future is basically the same. In a future mid-intensity conflict, basically conventional warfare and short of nuclear war, there may not be sufficient time to prepare elaborate defenses. Still, soldiers must have positions from which to fight and defend themselves.

The Army's basic field fortifications structures have changed little since World War II. However, military weapons and tactics have changed considerably in the last 20 years, and the old style bunker system may not lend itself to a highly fluid, mobile situation in future conflicts. This is why there is a need to find out what new concepts and developments are available for the Army to use.

The tests in MASSTER are only a part of a larger, Army-wide examination of field fortifications. The Army program itself involves a mix of



research, conferences and evaluations to determine specific requirements for different situations. Various Army schools and centers throughout the country are now evaluating the adequacy of standard field fortification structures and determining camouflage requirements. Thus, in the tests at MASSTER, the Army is finding out the answers to some basic questions. First, they are evaluating the design, techniques and tactical application of different protective structures. Second, they are determining the requirements for manpower, equipment and time to construct the different structures. Finally, they are discerning how much training is needed before soldiers know how to build the structures correctly.

With these goals in mind, MASSTER personnel will be reviewing both old and new concepts of underground bunkers made of new materials such as fiberglass, aluminum and plastic. Several new ideas relating to the use of bunkers for headquarters command posts will be studied. These ideas range from providing a covered hole in the ground to airlifting prefabricated modules that are then buried in the ground. Other structures involved in the testing include such single things as small box-like cages that are lined with plastic, filled with dirt and then stacked like blocks. Corrugated aluminum sheeting and reinforced plastic is also being used to form thick earth-filled walls for above-ground fortifications.

Several other shelters and fortification kits, such as those being used by the British Army and the US Marine Corps will also be evaluated. These kits work somewhat like the familiar erector set, with interconnecting pieces that allow several sizes

or shapes of structures to be built and covered with earth. When the structures are no longer needed, they can be disassembled and transported elsewhere for re-use.

One key consideration in the MASSTER test is the assumption that combat troops will have to be able to build and emplace all the different protective structures because trained engineer troops may not be readily available in a combat situation. Therefore, as part of the MASSTER test, all the structures will be assembled and disassembled at least two times by engineer troops and two times by non-engineer troops. Two groups from Second Armored Division units, the 17th Engineer Battalion and the Second Brigade, will provide personnel for the test.

Evaluation of the different structures in the MASSTER test will be made by more than 100 combat experienced soldiers from MASSTER and other units at Fort Hood, Texas. The evaluators will examine the structures and rate them on suitability, protection provided and several other factors. When this first stage of test and evaluation is completed, the accumulated results will be presented to a group of general officers at Fort Benning, Georgia, sometime in February. After this meeting, more specific attention and testing can be directed toward those shelters and fortifications that show the most promise for development.

So, in the future, soldiers may be glad that the serious business of digging and construction is being done by MASSTER now.

Captain Cecil Green is the Information Officer for Project MASSTER, Fort Hood, Texas.

ISSUES AND ANSWERS

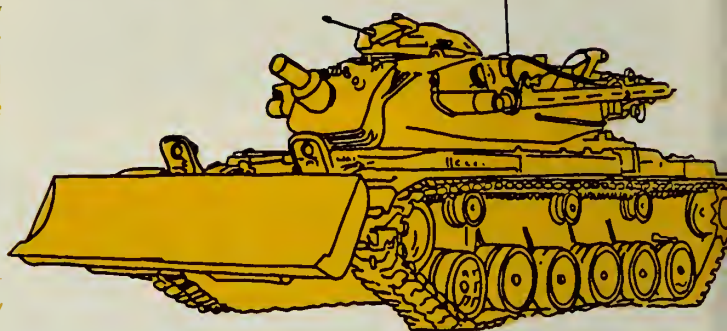


This article is published as the first in a new department known as "Issues and Answers." It is the hope of THE ENGINEER that it will generate comment and feedback on one of the tools of combat engineer units.

Some of the issues arising are:

1. Should crews of the CEV/AVLB be combat engineers or armor crewman specially trained to operate blades, boom, demolition guns and bridges?
2. Do crews of CEV/AVLB get an opportunity to practice with combined arms teams?
3. Do crews of CEV/AVLB get an opportunity to train using TC 17-14 frequently in order to be proficient in combat.
4. Do engineer unit commanders know the techniques of maintenance of combat vehicles?
5. Should CEVs be consolidated in one engineer unit similar to AVLB in the Bridge Company, then employed where the combined arms commander wants to influence the action?
6. Could the Army provide a better career for soldiers in MOS 12F, Combat Engineer Tracked Vehicle Crewman, by including them in MOS 11E, Armor Crewman, and providing additional skill training in the unit?
7. Does Army training literature sufficiently explain the doctrine, tactics, and techniques for employment of CEVs?

These are the issues. Do you as an engineer in the field have the answers? We would like to hear from you. Contact: THE ENGINEER Magazine, Bldg 269, Fort Belvoir, Virginia 22060.



LT Joseph H. Hottes

Although in sandy soil the combat engineer vehicle (CEV) can knock over trees that are several feet in diameter with only a slight grunt, and while the bark of its demolition gun can seemingly reduce anything to rubble, the CEV, like any military system, has its limitations. The purpose of this article is to focus on some of these limitations so that engineers can investigate these problem areas or users can consider them as they plan for the employment of this vehicle.

As envisioned in FM 5-1, the CEV is intended to assist the combat arms in a hostile environment by allowing its crew to perform pioneer tasks while being protected by armor. During a coordinated attack, CEVs will be with the assaulting elements. This use is highly likely in attacks on fortified or built-up areas. In the movement to contact, one could expect to find CEVs in the advance guard. The CEV, with its crew of four — commander, gunner, loader, and driver, has four tools to use to accomplish its mission — a demolition gun, dozer blade, winch, and boom.

The demolition gun will play a key role in reducing field fortifications. TC 17-14 notes the

Limitations of the CEV



crew must be able to "rapidly and accurately" engage targets, yet they must estimate the range to a target since no range finder or similar device is available. Cant, which is caused when one track is higher than the other, results in range and deflection error. No equipment is provided so that the crew may reasonably estimate the effect of this situation. Target acquisition is partially the gunner's responsibility. The field of view from his position is so severely limited that other crew members must guide him to the target. Troops operating near a firing CEV should know fragments from the exploding round can travel up to 1000 meters in any direction from the point of impact, and the maximum effective range for planning purposes is only 750 meters. The actual maximum effective range, however, is probably somewhat greater than 750 meters.

Since the crew's visual access to the dozer blade's immediate work area is somewhat restricted, feedback on the effects of its operation and guidance on its utilization are best provided from troops located outside the CEV. Individuals operating outside the vehicle must assist in the employment of the boom or winch. If the boom or winch is used, dismounted troops or crew members are potentially exposed to hostile fire. The headlights are not recessed, and trees can easily knock them off while the CEV is clearing abatis. Since movement of the CEV over dry ground throws a steady stream of dust over the vehicle, goggles are a must. Communication with the crew by way of the phone system on the rear of the vehicle is difficult due to the noise the vehicle makes and the lack of sufficient means for alerting the crew to incoming calls.

According to doctrine, the CEV should not be employed as a tank. However, detailed advice concerning its employment is not given in FM 5-1. For example, FM 5-1 notes that other armored vehicles must protect the CEV against antitank fire, but the manual does not explain how a CEV is to maneuver with tanks. Even though school training for the CEV commander is available, according to ATP 5-25, all crew members, including the commander, may be unit trained. Proficiency in MOS 12F requires that the individual be knowledgeable in the operation of both CEVs and armored vehicle launched bridges (AVLB). Most units that have a CEV do not have an AVLB and vice versa. Therefore arrangements must be made to share equipment if the men are to receive training on both vehicles. Crews firing for familiarization are to fire only four target practice rounds per crew member. Although a target practice round or subcaliber round will most likely cost less than a HEP-T round, none are presently in the Army inventory.

The CEV may have its limitations, but it increases the likelihood combat engineers will be able to accomplish their mission. Recognizing the limitations of any item of equipment is an important step in evaluating its effectiveness.

LT Joseph H. Hottes is presently a platoon leader with Co C, 682d Engr Bn. He received his MS from Iowa State University. LT Hottes has served with the Iowa National Guard since 1967 and as a commissioned officer since 1969. He is a graduate of the Engineer Officer Basic Course and recently graduated from 2-74 Engineer Officer Advanced Course.

BRIDGING

NEW PAMPHLET BEING DISTRIBUTED TO ENLISTED PERSONNEL

A PERSONAL COPY OF new DA Pamphlet 624-1 (**Your Pathway to Success: The Enlisted Promotion System**) will be distributed to all Army enlisted members this fall.

The pamphlet — prepared by MILPERCEN's Enlisted Personnel Directorate — is designed to provide the soldier and his supervisor with a comprehensive, easy-to-follow approach to how the enlisted promotion system works and how it is supported at the various levels, from the unit on up to Department of the Army.

MILPERCEN's enlisted career managers consider the document important enough to distribute a personal copy to every soldier on active duty, especially at this time when the volunteer Army is attracting increasing numbers of career-minded men and women who want to know all they can about advancement in the ranks and what they must do to get promoted.

Divided into four sections, the new pamphlet addresses both the individual soldier's responsibility and the Army's efforts to maintain an equitable and steady system of advancement within the enlisted ranks.

The first section contains general information and stresses the Army's reliance on a wide range of factors when considering the soldier for promotion the "whole person concept." It also lists simple steps that the individual can take to improve his chances for promotion and describes the military and civilian educational opportunities available to servicemen. These include training and testing in his Military Occupational Specialty (MOS) and the Non-commissioned Officers Education System (NCOES), and Army-assisted degree completion programs for civil schooling.

Section Two details each level of the current promotion system — Decentralized (initiated by the Unit Commander for Grades E-2 to E-4), Semi-Centralized (made in Grades E-5 and E-6 by Field Commanders and DA, working together) and Centralized Promotions (coordinated for Grades E-7 through E-9 at DA level). Included are the requirements and factors of work on each level of the Promotion system and a summary of the centralized promotion board procedures.

Section Three familiarizes the soldier with the installations which support the Enlisted Promotion System. Functions of the U.S. Army's Military Personnel Center (MILPERCEN), in Alexandria, Virginia, and the Enlisted Evaluation Center (EEC) and Enlisted Records Center (ERC), both located at Fort Benjamin Harrison, Indiana, are described in detail. The soldier is also provided with specific information on his official military personnel file and instructions on which of the three agencies to contact should he need to resolve personnel-related matters.

The fourth section contains appendices to the main body of the pamphlet; lists related Army Regulations, Circulars, and Pamphlets to be consulted for further information; and includes actual reprints of the Promotion Points Worksheet and Letters of Instruction to both the E-9 and Advanced NCOES Selection Boards.

Field units will be able to requisition individual copies for all unit members via pinpoint distribution. A world-wide message containing requisitioning instructions for DA Pamphlet 624-1 will be released as soon as the pamphlets have been printed and are ready for distribution.

Females may participate in nine additional MOS's, bringing the total of 437 of 479 enlisted MOS's now available to WAC personnel.

Additional details appear in DA message DAPC-PM 141200Z May 74.

THE GAP

NEW HANDBOOK PREPARED BY MILPERCEN ENLISTED DIRECTORS

THE NEW "HANDBOOK FOR PREPARING SOLDIERS TO MOVE OVERSEAS" has been distributed to all CONUS installation/activities requesting port calls. The handbook was prepared by the Enlisted Personnel Directors, US Army Military Personnel Center, to assist the administrative personnel responsible for POR processing by providing a single reference guide for use in determining eligibility for overseas assignment.

All information contained in the guide is current as of Aug. 1, 1974.

OPMS SPECIALTIES ADDED TO OFFICER MASTER FILES

THE PRIMARY OPMS SPECIALTIES for lieutenant colonels were added to the Officer Master File maintained at the US Army Military Personnel Center effective Aug. 15. Each record in the file now shows the LTC's primary specialty; alternate specialties are programmed for inclusion by mid-October.

PERSONNEL ASSISTANCE POINTS TO BE ESTABLISHED

SOLDIERS ENROUTE TO OR returning from overseas assignments will get better attention once the Army Personnel Centers (Fort Dix, Fort Jackson and Oakland Army Base) and the Returnee-Reassignment Stations (Travis AFB, McGuire AFB and Charleston AFB) are reorganized and converted into US Army Military Personnel Center (MILPERCEN) Personnel Assistance Points. Conversion of these currently independent centers and stations to Personnel Assistance Points will begin on or about October 1.

The reorganization/redesignation of these points into field operation activities of MILPERCEN will give soldiers a direct point of contact with MILPERCEN while they are traveling to or from overseas duty stations. The offices will be open 24 hours a day, seven days a week, and staffed with "extremely well qualified people," according to MAJ George Fasching, Chief, Personnel Movements Branch, MILPERCEN.

"About 30,000 soldiers pass through these terminals each month; until the idea of Personnel Assistance Points evolved, they had no way of contacting us on a timely basis, just as we at MILPERCEN had no real way of contacting them while they were enroute. We have designed the Personnel Assistance Points to counteract this problem — to give the soldiers direct contact with MILPERCEN while they are in a travel status."

The Personnel Assistance Point officials will not only have the authority to coordinate directly with enlisted assignment managers and compassionate review and policy offices at MILPERCEN; they will be able to verify assignment, administratively amend orders, extend emergency leave and terminate it when the soldier reports in, help with compassionate problems and offer personal advice to those in a travel status.

Prior to the development of the Personnel Assistance Point, if a soldier had a personnel problem, he was attached to the nearest installation, and waited until that problem was resolved through channels. By being located where the soldier needs it most, the Personnel Assistance Points will be better able to assist him in moving overseas or returning stateside with a minimum of delay.

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THE ENGINEER MAGAZINE
USA ENGINEER SCHOOL
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THE ENGINEER



SUMMER | 1975

THE ENGINEER

VOLUME 5

NUMBER 2

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CHIEF'S BRIEFS

Stephen H. Long, last Chief of the Corps of Topographical Engineers, was born December 30, 1784 in Hopkinton, New Hampshire.

Appointed a second lieutenant in the Corps of Engineers in 1814, Long taught mathematics at West Point for two years. In 1816 he was transferred to the topographical engineers with the brevet rank of major and remained with this branch for the rest of his career.

In 1817 Long conducted extensive explorations in the Northwest. Commanding the expedition to the Rocky Mountains in 1819-1920, he discovered the peak which bears his name. Colonel Long was then assigned to explore the northern boundry of the United States, which he fixed at the 49th parallel at Pembina (now in N. Dakota), in 1823.

In 1827 he helped select the route of the Baltimore and Ohio Railroad and became its Chief of Surveys and a member of its Board of Engineers. The expertise developed by this experience enabled Long to author the first 'Railroad Manual' in 1829.

Colonel Long in 1836 obtained patents on his method of bracing and counterbracing wooden bridges, an area in which he became interested through his railroad work. Many early railroad bridges were constructed according to his specifications.

Long for years was chief engineer for the improvement of western rivers, with headquarters at Louisville and later at St. Louis in 1858.

On September 9, 1861 Colonel Long became Chief of the Corps of Topographical Engineers. Upon merger of the two corps on March 3, 1863, he became the senior officer to the Chief Engineer, Corps of Engineers. He retired the same year.

Stephen H. Long died at Alton, Illinois on September 4, 1864.

John M. Dervan
Asst. Curator, US Army Engineer Museum

United States Army Engineer School Fort Belvoir, Virginia

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The Engineer is an authorized quarterly publication of the U.S. Army Engineer School. It is published to provide factual and in-depth information of interest to all Engineer units. Articles, photographs and art work of general interest may be submitted for consideration to: Editor, The Engineer, USA Engineer School, Fort Belvoir, Virginia 22060. Views and opinions expressed herein are not necessarily those of the Department of the Army. Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, January 1, 1974.

Engineer Magazine Telephone: (703) 664-2838 —
Autovon: 354-2838

ABOUT THE COVER

Captain John V. Kauffman's painting depicts the twin roles performed by Engineer Corps personnel: they undertake all the activities commonly associated with soldiering, and as combat engineers, both during war and peace, they engage in a whole range of engineering activities requiring skills, precision and selflessness.

PIPELINE. PIPE

RECREATION OPPORTUNITIES DETAILED IN CORPS PHAMPHLETS

Outdoor enthusiasts can now avail themselves of free Directories of Recreation Opportunities at US Army Corps of Engineers Projects.

Six directories covering the continental USA are available: New England, Northeast, Midwest, West, Southwest and Southeast.

Each contains a detailed map and lists the various outdoor facilities.

For your copy write to:
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Washington D. C. 20314



NONRESIDENT COURSE DETAILED

Engineer Officers who have graduated from their branch advanced courses are encouraged to apply for enrollment in the Command and General Staff College non-resident program.

The course closely parallels

the resident program and is designed to prepare officers for duty as commanders and general staff officers.

A course description is available in DA Pamphlet 350-10. This can be obtained by writing, The Commandant, Command and General Staff College, ATTN: DNRI, Ft. Leavenworth, Kansas 66027.

ENGINEER OFFICERS AND WARRANT OFFICERS DIRECTORY AVAILABLE

The Directory of Corps of Engineers Officers and Warrant Officers (1975 Edition) is available for purchase at the USAES. Mail order requests should be sent to: USAES Periodical Publications Fund, Office of the Secretary, USAES, Fort Belvoir, VA 22060. Cost is \$2.25 per copy (covers handling and mailing costs). Make checks payable to: USAES Periodical Publications Fund.

FAR EAST DISTRICT, CORPS OF ENGINEERS SEEKS ASSISTANCE

Information is being compiled for a history of the Far East District, Corps of Engineers, 1957 to 1975. If anyone has general information, anecdotes, photographs, newspaper clippings, brochures, maps, or the like concerning the District, please contact Earle Whitmore, Historian, Far East District, Corps of Engineers, APO San Francisco 96301. Any temporary loans, such as news

clippings, photographs, or maps, would be duplicated and returned immediately.

THE DMA APPROVED DEFINITION OF MC & G

"Mapping, charting, and geodesy (MC&G) comprises the collection, transformation, generation, dissemination, and storing of geodetic, geomagnetic, gravimetric, aeronautical, topographic, hydrographic, cultural, and toponymic data. These data may be used for military planning, training, and operations including aeronautical, nautical, and land navigation, as well as for weapon orientation and target positioning. The data may be presented in the form of topographic, planimetric, relief, or thematic maps and graphics; nautical and aeronautical charts and publications; and in simulated, photographic, digital, or computerized formats."

"MC&G does not include the evaluation of topographic, hydrographic, or aeronautical features for their effect on military operations or intelligence."

STATUS OF FAMECE

The Validation Phase In Processing Review (IPR) for the Family of Military Engineer Construction Equipment (FAMECE) was held at the USAES 31 Oct - 1 Nov '74. The IPR concluded that the results of the competitive prototyping effort, to include Developmental Testing/Operational Testing demonstrated the Military worth of FAMECE and

LINE. PIPELINE.

recommended that the program enter Full Scale Development (FSD). The recommendation was approved by Deputy Chief of Staff for Research, Development and Acquisition when it approved the IPR minutes on 16 Dec. '74. Subsequent to this action an announcement was made by the Source Selection Authority of the contractor selected for FSD and a contract was awarded to the Clark Equipment Company on 24 Dec. '74.

Clark Equipment Company will build two additional prototypes (dumper and loader modules) for delivery in early 1976. The entire family (17 complete vehicles — 2 of each vehicle plus an extra dumper vehicle) is scheduled for delivery in the fall of 1977 for testing in 1977 and 1978. The family is scheduled for fielding in 1980.

CHANGE TO EOAC

The recent change in lengths of the Engineer Officer Advanced Course (EOAC) will be implemented at the USAES with class reporting in September 1975. The EOAC will be 26 weeks in length, a reduction from 32 weeks. The changes to accomplish this reduction are elimination of all electives and reduction of some technical aspects of engineering and some corresponding increases of military engineering. The course purpose remains the same: "To prepare engineer officers to be technically, tactically and administratively competent Company Commanders and Battalion Staff Officers (including a refresher

at Platoon Level). Emphasis is placed on the management of training at the squad, platoon and company level." The 26 week course is presently being systems engineered and in-resident EOAC students are assisting in this effort to provide the field input as to what tasks should be included in resident training. The overall objective is to qualify the graduate as a military engineer to meet primary specialty under OPMS.

CRELL Test New Concrete Application

Savings in highway construction costs throughout the country are being sought through a long term study being conducted at the U. S. Army Cold Regions Research and Engineering Laboratory (CRREL).

A test road section was constructed in 1971 to compare standard construction techniques utilizing a granular base course between the road subgrade and the asphaltic concrete surface, with one in which a thick asphaltic concrete (ABC) pavement is applied directly to the subgrade. This latter method eliminates the cost of the granular base course, usually gravel and sand.

The road section, located adjacent to the CRREL facility, leads to the Hanover town gravel pits and is subject to heavy truck traffic, particularly during the frost melting period. This is the most critical time to the year for proper performance of roadways.

In the study, which is expected to run for ten years, measurements are made of pavement strength, degree of frost heave, and depth of frost penetration in the roadway. In addition to normal traffic, the pavements are subjected to repeated loads simulating added traffic to study the structural response of the roadway. The testing is conducted when the pavement section is frozen, thawing, and completely thawed.

Results to date indicate that there is a greater than normal degree of frost heaving in the section without the base course. However, the heaving tends to be at a uniform rate, leaving a relatively smooth pavement surface. The roadway returns to near normal after the spring thaw.

The uniformity of the subgrade is the key factor for the development of uniform heaving. In construction the subgrade was prepared by scraping, blending, and recompacting 18 inches of the native silty subgrade soil.

In the spring, the subgrade beneath the ABC section was found to have a high water content. The water cannot easily drain through the fine grained silt and results in a reduction in the pavement's load carrying ability.

Seeking to solve this drainage problem, a related study is being conducted in which a tough, porous fabric, overlain with a layer of porous asphalt, is placed below the asphaltic concrete wearing surface to provide proper drainage. Preliminary results from this study are supporting the feasibility of this concept.

ENGINEER

Engineer Personnel Managers in OPD — Reorganization of OPD has taken place. Listed below are the players, their organization and their telephone numbers. The "P" is still in Personnel and Profession.

Colonels Division: (DAPC-OPC-AE)

Engineer Assignments, LTC Thomas Sands, 325-7871

LTC Division: (DAPC-OPL-AS)

Engineer Assignments, LTC Henry Covington, 325-0423

Majors Division: (DAPC-OPM-AS)

Engineer Assignments, MAJ Ted G. Stroup, 325-8107

Combat Support Army Division: (DAPC-OPF-EN)

Division Chief COL Carl P. Rodolph 325-0628

Engineer Branch Chief LTC Charles E. Eastburn 325-7434

CPT Assignments MAJ James E. Corbin 325-0650

LT Assignments CPT Milton Hunter 325-0651

Professional Development MAJ Martin Suydam 325-7426

Warrant Officer Division: (DAPC-OPW-WU)

Engineer Assignments CW4 Jean L. Derby 325-7837

(For Autovon dial 221 and the last four digits)

The mailing address remains the same: 200 Stovall Street, Alexandria, Virginia 22332

OPMS — Alternate specialty designations have now been made for all Engineer officers with greater than seven years of active commission service. The spectrum of specialties that is compatible with being an Engineer are extremely broad. Table 1 shows the percentage of Engineer officers by grade designated into various alternate specialties. The table is reflective of the diversity of the Army's requirement in alternate specialist for engineer officers beyond the eighth year of service. As you would expect, the heaviest concentrations are in specialties oriented on the applied physical sciences and analytical techniques. However, there are large requirements in other areas for officers with engineer skills and aptitudes. Since alternate specialty designations are based on the size of the specialty requirements at higher grades, you can see that there are indeed multiple path routes to success.

ALTERNATE SPECIALTY DESIGNATIONS PERCENT BY GRADE

ALTERNATE SPECIALTY		LTC %	MAJ %	CPT 7 YRS %
Infantry	11			
Armor	12			
Field Artillery	13			
Air Def Artillery	14			
Cmbt Comm-Elec	25			
Fixed Telecomm Syst	26			
Comm-Elec Engr'g	27			
Audio-Vis Instr Tech	28		1	
Law Enforcement	31		1	1
Tact/Strat Intell	35	2	2	5
Counterintell/HUMINT	36		1	1
Cryptology	37		1	
Personnel Mgmt	41	8	6	6
Personnel Admin	42	1	1	1
Club Mgmt	43			
Finance	44			

POTPPOURRI

Comptroller	45	3	3	3
Information	46	1	1	1
Education	47	9	10	7
Foreign Area	48	11	9	9
OR/SA	49	4	8	9
R&D	51	22	23	20
Atomic Energy	52	8	5	6
ADP	53	2	3	3
Ops & Force Dev	54	13	10	11
Avn Mat Mgmt	71	1	1	1
Comm-Elec Mat Mgmt	72			
Missile Mat Mgmt	73			
Chemical	74			
Munitions Mat Mgmt	75	1		
Armament Mat Mgmt	76			
Tank/Ground Mob Mat Mgt	77	1	1	1
POL Mgmt	81		1	1
Food Mgmt	82			
Gen Trp Spt Mat Mgmt	83		1	1
Traffic Mgmt	86	1		
Mar & Term Opns	87	1	1	1
Hwy & Rail Opns	88		1	1
Maint Mgmt	91	3	5	5
Supply Mgmt	92	6	5	4
Log Svcs Mgmt	93	1	1	1
Transportation Mgmt	95		1	
Procurement	97	5	5	4
Logistics	98			

TABLE 1.

Stability . . . Expect 36 months on station except for short tour areas. If you have questions concerning the date when you will be next available for reassignment, contact your assignment officer. The name of the game is stay put and do a professional job.

GRADUATE SCHOOL NOTES:

Graduate School Opportunities in FY 76. We anticipate the following graduate school input during FY 76 in support of Army requirements:

FUNDED GRADUATE TRAINING

PARTIALLY FUNDED TRAINING

AERB	31	Degree Completion Program Bootstrap	16
USMA Instructor Training	20	Advance Degree Program for ROTC Instructor Duty	19
USMA/Rotc Top 5%	20	Cooperative Degree Program	5
TOTAL — 111			

Fully Funded Advanced Degree Training (AR 621-1, Chapter 4). This is the principal program for obtaining a graduate degree and provides the primary means to train officers at the masters level. Application is made by forwarding DA Form 1618-R. An officer's application is automatically considered each time he becomes available for reassignment. The primary zone for consideration for schooling is 5 to 14 years service. An outstanding overall record of performance is necessary to be a contender for selection. For planning, the FY 76 input will be in these disciplines: 22 Civil Engineers, 1 Geodetic Science, 1 Topography/Photogrammetry, 1 Foreign Area Studies, 1

ENGINEER

Procurement/Logistics Management, 1 ADPS Engineering, 1 Nuclear Physics, 1 ADPS Business, 2 ORSA Engineering.

School Input	CALENDAR Application Due	Selections Announced
Jan 76	1 Jul 75	15 Aug 75
Jun 76	1 Nov 75	15 Jan 76
Sep 76	1 Feb 76	15 Mar 76

Advanced Degree Program for ROTC Instructor Duty (AR 621-101). ROTC inputs preceded by graduate training are being programmed ahead as far as the summer of 1978. Quotas will permit 19 Engineers to enter graduate school in FY 76 with a follow-on ROTC assignment.

Degree Completion Program (Bootstrap) for Graduate Degree (AR 621-1, CH 8). Thinking about beginning a masters degree off-duty with a goal of obtaining a "bootstrap" to finish degree requirements? Good plan, but be sure that the academic discipline is one which we can support. All new participants after July 1975 must study in an academic discipline for which an AERB position exists and serve in a follow-on utilization assignment.

GRADUATE CIVIL SCHOOL ACADEMIC DISCIPLINES. Regardless of program, Army sponsored graduate training is restricted to those disciplines in which the Army Educational Requirements Board has validated requirements and a "shortage" of qualified officers exists. Currently, for Engineer officers these disciplines are as listed below:

BUSINESS:

BAL ORSA Analyst
BAM Comptrollership
BAN ADPS Business
BBF Logistics Management
BBP Procurement

ENGINEERING:

CCX Civil Engineering
CFX Aeronautical Engineering
CLX Nuclear Effects Engineering
CEX Chemical Engineering
CSX Engineering Physics
CUC ORSA Engineering
CUA ADPS Engineering

PHYSICAL SCIENCE:

DEX Geodetic Science
DED Topography & Photogrammetry
DLX Physics
DLD Nuclear Physics

SOCIAL SCIENCE:

EBX Foreign Area Studies

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UNDERGRADUATE SCHOOL NOTES:

Degree Completion Program (Bootstrap) (AR 621-1, Ch 8). The current estimate is that 40 Engineers will initiate undergraduate training under this program during FY 76. The maximum period of training that can be supported is 18 months. Our objective is to support those officers with outstanding performance records in obtaining a bachelors degree in disciplines that the Army can use. These disciplines are too numerous to list, but undergraduate education directed in the areas where graduate level shortages exist get preferential consideration. See the disciplines previously listed.

School Input	CALENDAR Application Due	Selections Announced
Jan 76	Jul 75	Aug 75
Jun 76	Dec 75	Jan 76
Sep 76	Mar 76	Apr 76

ADVANCED COURSE CLASSES SCHEDULED

Engineer Officer Advanced Course (EOAC) classes beginning after 1 July 1975 will be reduced in course length from 32 weeks to 26 weeks. Three Advanced Course classes are scheduled for FY 76.

EOAC	1 - 76	28 Sept 75	20 Apr 76
	2 - 76	8 Feb 76	12 Aug 76
	3 - 76	6 Jun 76	14 Dec 76

The FY 76 schedule for the 12 week long Engineer Officer Basic Course (EOBC) classes is as follows:

EOBC	1 - 76	10 Jul 75	3 Oct 75
	2 - 76	26 Aug 75	21 Nov 75
	3 - 76	20 Oct 75	30 Jan 76
	4 - 76	8 Jan 76	2 Apr 76
	5 - 76	5 Feb 76	30 Apr 76
	6 - 76	8 Apr 76	2 Jul 76
	7 - 76	12 May 76	6 Aug 76

Engineer Noncommissioned Officer Advanced (ENCOA) and Basic (ENCOB) courses are programmed in accordance with career management fields.

4 ENCOA course and 20 ENCOB courses are scheduled for FY 76. Details and dates of courses are available in USAES Pam 350-1, or contact

Chief, Resident Training Management Division
United States Army Engineer School
ATTN: Operations Branch
Fort Belvoir, Va 22060

OPD Reorganization

Colonel Carl P. Rodolph, Jr.

On 19 May 1975, the Officer Personnel Directorate, U.S. Army Military Personnel Center, Department of the Army, was reorganized and the traditional "branch concept" of personnel management, as we once knew it, was eliminated. This is the most evolutionary change in officer career management since the inauguration of the Officer Personnel Act of 1947. Essentially, the reorganization permits the "streamlining" of OPD for optimum professional development and utilization under the Officer Personnel Management System (OPMS) as promulgated by the Chief of Staff, Army in March 1973. Although the OPD internal reorganization has been completed, assignments will not fully be made by primary and secondary specialties until January 1976. As a matter of review, OPMS has three primary objectives for officer professional development:

- To develop officers in the proper numbers and skills to meet Army requirements and maximize the individual officer's abilities, aptitudes and interests.
- To assign officers based upon Army requirements and within capabilities in consonance with individual competence and desires.
- To improve the overall motivation and professional satisfaction of the Officer Corps.

Before launching into reorganizational changes, it is important to review the previous configuration of OPD. Figure 1 delineates the traditional OPD organization consisting of 14 separate branches, a Colonel's Division, and the functional chiefs (Professional Development and Plans, Distribution and Personnel Actions). Historically, branches primarily have been concerned in making assignments to meet Army requirements. Professional development, an equally important mission, was accomplished, by some branches, in a secondary fashion. Further, there was no central "clearing house" to insure that an officer selected for an assignment in a specific grade was in fact the best qualified member of a Special Career Program (SCP). For example, when OPD previously received a requirement for a lieutenant colonel qualified in Operations Research and Systems Analysis (ORSA), the requirement for fill was given to a branch having an available ORSA

qualified officer. There was no internal OPD mechanism to determine if the best qualified and available LTC from among all branches was placed against the requirement. The single OPD exception was in the Colonel's Division, created in 1962, which receives all O-6 requirements and assigns officers worldwide based upon a total review of individual qualifications and experience. The "success story" in the Colonel's Division was in many ways a precursor to the OPD reorganization. The Colonel's Division, retained as previously organized, is depicted in Figure 2. The 14 career branches have been replaced by 6 divisions which manage lieutenant colonels, majors, company grades and warrant officers. Three of the 7 divisions are configured to handle the assignment and professional development of all company grade officers and are grouped as *Combat Arms* (Armor, Artillery, Infantry and Air Defense Artillery), *Combat Support Arms* (Engineer, Military Intelligence, Military Police and Signal) and *Combat Service Support* (Ordnance, Quartermaster and Transportation). The three functional chiefs (Professional Development, Distribution and Resource Management) retained the bulk of their previous responsibilities, exclusive of some internal OPD alignments.

The OPD reorganization is more than cosmetic and the impact upon officer professional development is far reaching. For example, by this fall, all field grade officers will be managed by specialty in the appropriate division commensurate with their grades. Under this personnel management concept, each division, like the Colonel's Division, will receive all requisitions and assign officers based upon primary or alternate specialty qualifications. To assist field grade divisions in the management of personnel, each division will have a number of multiple Specialty Management elements (assignment officers), a Professional Development Branch, Personnel Actions Branch and Personnel Support Branch. Specialty managers will have responsibility for the assignment of all officers in two or more specialties. For example, a lieutenant colonel, with Engineer as his primary specialty, would direct requests for information to the Engineer Specialty Manager of the Lieutenant Colonel's Division. However, if the engineer officer had an

OFFICER PERSONNEL DIRECTORATE

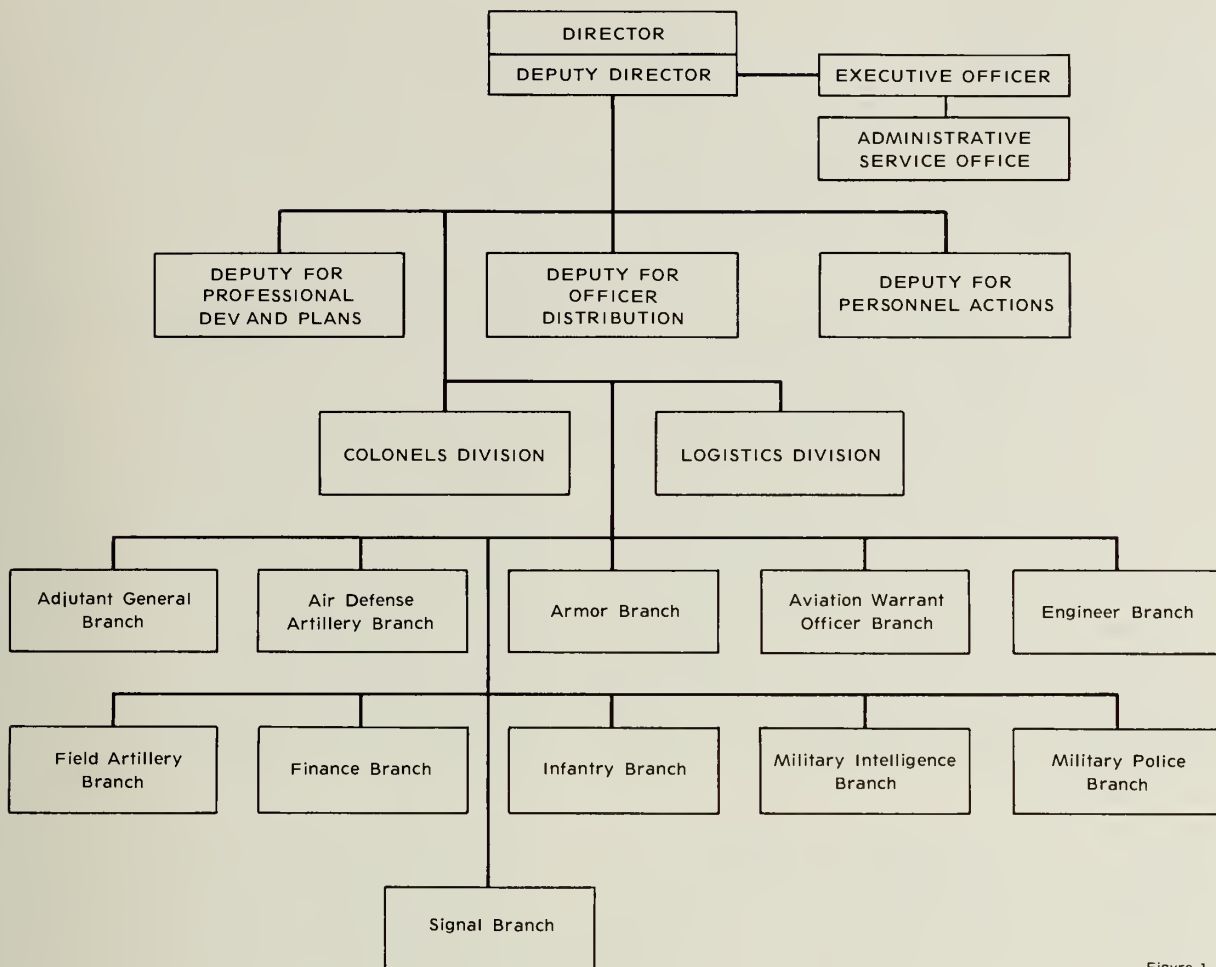


Figure 1

NEW ORGANIZATION

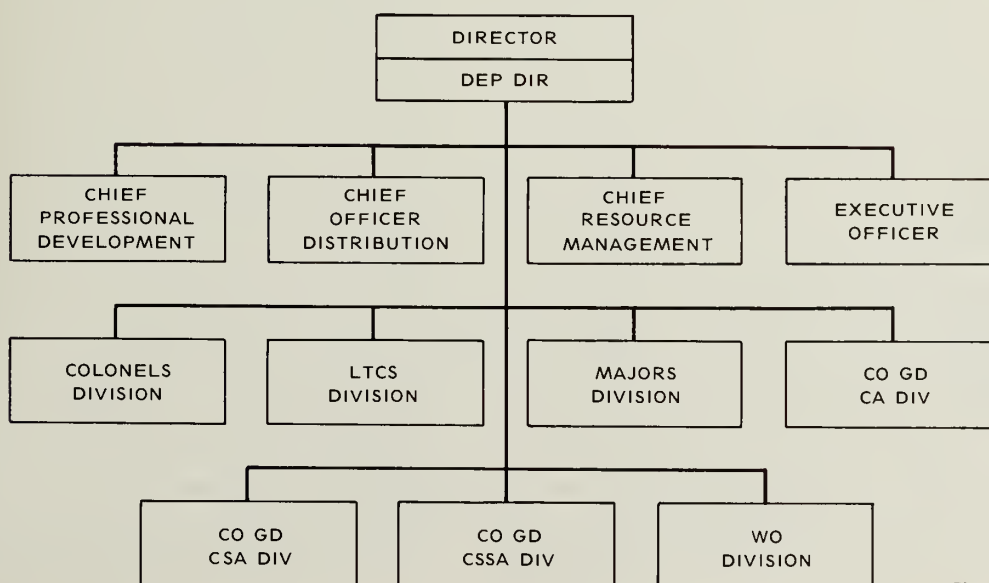


Figure 2

alternate specialty of Operations and Force Development, he would make contact with the lieutenant colonel managing Foreign Area Officer (FAO) and Operations and Force Development specialty assignments. The Lieutenant Colonel's Division organizational structure is illustrated in Figure 3. By now it should be obvious that each Army officer must "check into the net" with two assignment officers, primary and alternate, to receive information and professional development guidance.

As a matter of interest, one of the perennial OPD problems has been the dichotomy between the assignment officer, who is faced with the inescapable fact of getting a qualified individual on station within acceptable time limits, and the professional development officer, who primarily is concerned with the individual development of an officer *today* to meet an Army requirement in the *future*. All too frequently, the professional development must be temporarily deferred to meet an immediate high priority officer requirement. This accommodation is most pronounced during periods of conflict. However, proper balance in assignments/professional development must, and will, be kept in the proper perspective in the new OPD organization.

At the beginning of this article, the demise of the traditional "branch concept" was mentioned. In a practical sense, branch association has been replaced with specialty for field grade officers. However, as a result of organizational identity and pride, DA decided to preserve the current branch concept for company grade officers. Therefore, CA, CSA, and CSS Divisions — each headed by a colonel — will retain the current structure in the assignment branches. For example, the CSA Division will consist of a total of 7 branches: Engineer, Military Intelligence, Military Police, Signal, Professional Development, Personnel Actions, and Personnel Support.

Figure 4 illustrates the Warrant Officer Division — a totally new and centralized management organization for warrant officers. Previously, aviation warrant officers were managed by a single OPD element, while the remainder were handled by their respective career branches. The consolidation of warrant officer management and professional development was inevitable because of the duplicatory efforts in Warrant Officer Aviation Branch and other career branches. Warrant officers now have a central point of contact concerning career management.

The Officer Personnel Directorate is quite

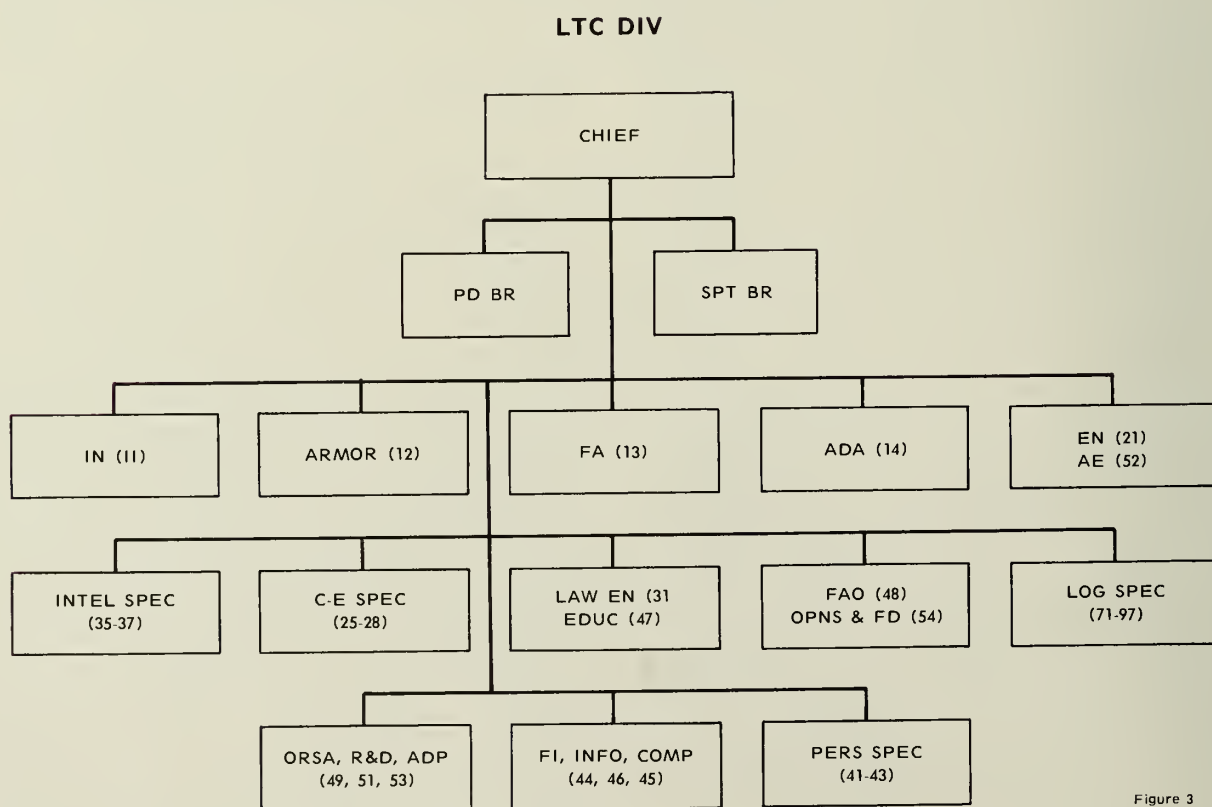


Figure 3

WARRANT OFFICER DIVISION — OPW

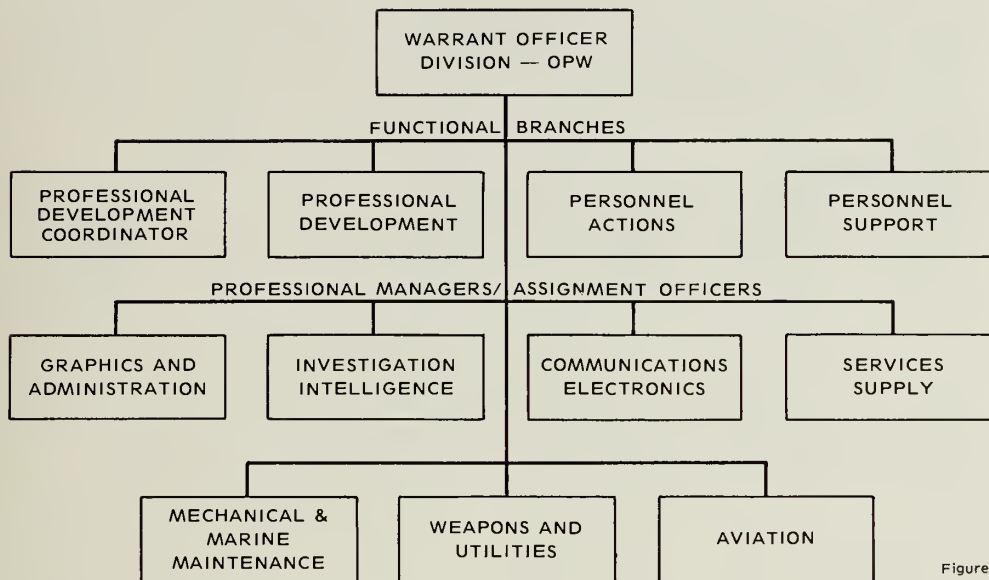


Figure 4

enthused with the new organization and anticipates the assignment officer playing even a greater future role in the assignment and professional development responsibilities for Army officers. The Assignment and Professional Development officer will coordinate freely with counterparts of other OPD Divisions and functional chiefs to insure optimum career development. Additionally, specialty monitors located at the functional chief level will be responsible for "orchestrating" the efforts of Division Professional Development officers. The specialty monitors also act as the point of contact for agencies, external to OPD, coordinating plans and policies regarding OPMS specialties.

There is some genuine concern of Engineer officers who have become accustomed to specialized career development treatment by Engineer Branch in the past. The question most frequently asked is: "Will the 'P' in personnel be lost in the new organizational maze?" The answer is no! In reality, OPMS is nothing more than a formalization of an informal management procedure that has been practiced in the Corps of Engineers for years. Each officer will continue to have a "resident OPD expert" who is vitally interested in the individual, the assignment, and the officer's professional development. As General Abrams, our former Chief of Staff, Army, so aptly stated in his indorsing comments of DA Pamphlet 600-3, "Offi-

cer Professional Development and Utilization", March 1974, "... how well you do in the Army depends not on our system of management but rather on your individual efforts and dedication to service."

Colonel Carl P. Rodolph, Jr., is Chief of the Combat Support Arms Division, Officer Personnel Directorate, Military Personnel Center, Department of Army. He was previously the Chief of Engineer Branch, OPD, MILPERCEN. Since being commissioned in 1952, he has served in a variety of command and staff assignments to include construction units in Europe; Vicksburg Engineer District; HQ, 8th US Army, Korea; tours with both ACSI and ACSFOR on the Army staff; and a previous tour in the Engineer Branch, OPD. Colonel Rodolph's Vietnam tours include assignments as engineer, 173d Airborne Brigade (Separate), CDR, 577th Engineer Battalion (Construction) and CDR, 326th Engineer Battalion, 101st Airborne Division (Airmobile). He recently served as CDR, U.S. Army Engineer School Brigade, Fort Belvoir. Colonel Rodolph is a graduate of the Engineer OAC, the Command and General Staff College and the National War College. His civilian education includes degrees in Industrial Management, Civil Engineering and International Relations. Colonel Rodolph is a registered professional engineer.

Getting The Gas Out

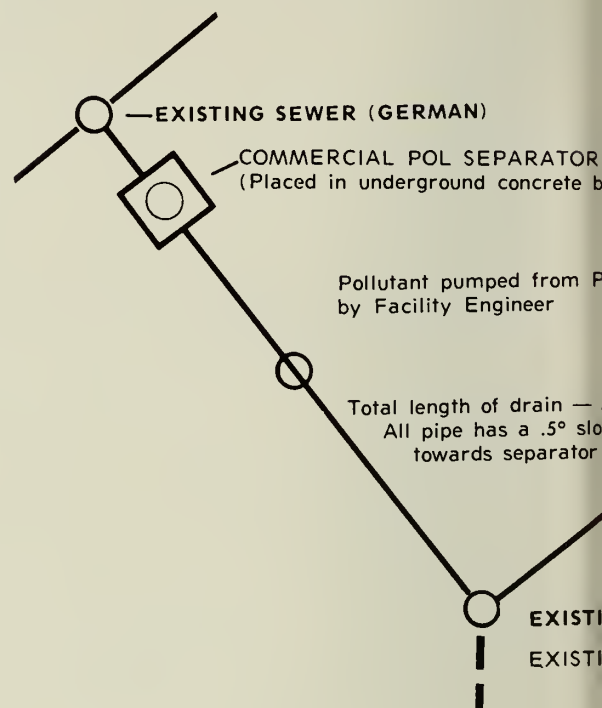
CPT William T. Maddox

During the fall of 1971, an excavation for an autobahn interchange near Aschaffenburg, Germany, produced soil that smelled like gasoline. Further investigation revealed that most of the surrounding land was also polluted. The German Waterway's Commission began a systematic search for the source which led them to a US Army Class III Point located on the edge of the city. At approximately the same time, a brewery one mile from the Class III Point discovered the presence of hydrocarbons in its well water.

Excavations in the area adjacent to the Class III Point indicated that all land north of the Class III Point was saturated with fuel. Army personnel began to dig test holes within the confines of the Class III Point. As a result, it was discovered that an underground pipe, previously a fill stand for tankers, had been leaking into the ground. This pipe had been capped off above the ground after an accident had damaged the remainder of the fill stand. It was surmised that the pipe had been leaking since the accident. Tests taken in the area showed that the fuel was passing through the soil into the natural underground water system and being carried downstream to the wells of the brewery. A large amount of the pollutant was also being absorbed into the soil on the north or downstream side of the Class III Point.

To provide an immediate solution, earthmoving equipment was used to remove all of the topsoil in the open field north of the Class III Point. Large open ditches were dug to a depth below the natural water table in order to allow the pollutant to "surface" with the water that filled the ditches. This polluted water was then pumped out of the ditches by 5000 gallon fuel tankers and dumped in a place chosen by the German authorities. This system failed due to the fact that a large quantity of water had to be pumped from the ditches in

The pollutant flows on the surface of the water until it is stopped by the polyethylene film. It is then trapped by the gravel and flows into the perforated pipe.

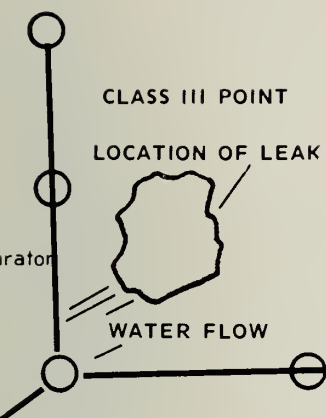


order to remove a small amount of pollutant. Since this method was time consuming and did not produce a lasting solution, it was abandoned after four months.

In March, 1972, US Army Engineer Command, Europe, called on the 293rd Engineer Battalion (Const), to install a more efficient and longer lasting system. As designed by ENGCOM and the Facility Engineer, Aschaffenburg, the plan called for the installation of a POL separator and French Drain. The French Drain was to be installed as shown in Figures I and II. With this drain installed on the "downstream" side of the Class III Point, it was hoped that all of the pollution would be "skimmed" from the surface of the natural water.

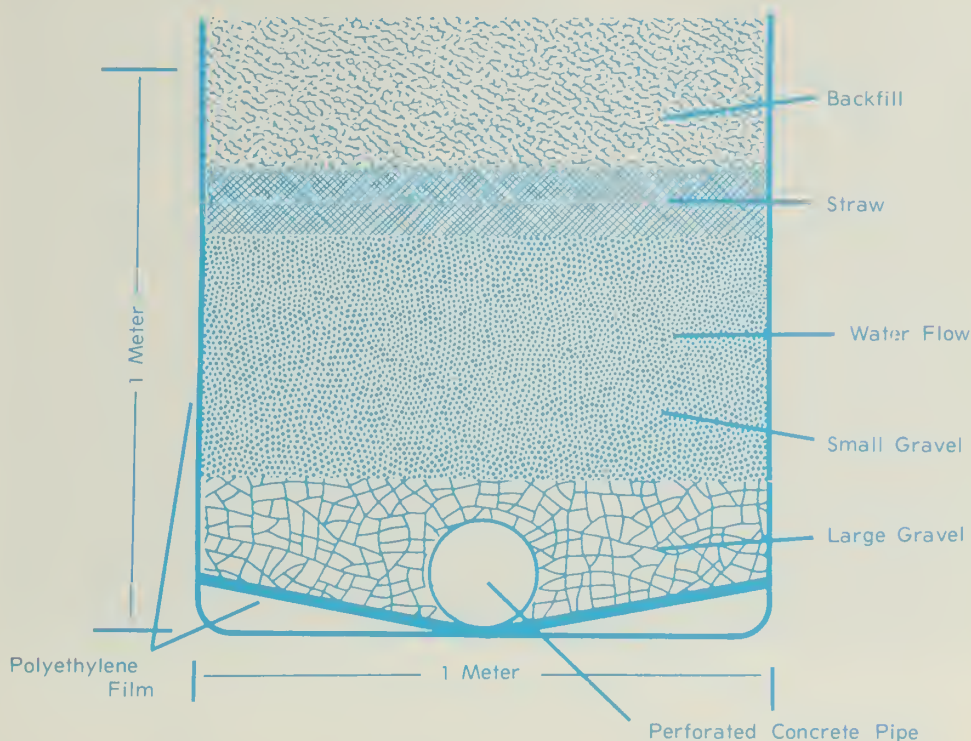
In order to be effective, the French Drain had to be installed below the natural water table, and at a level where it would intercept the pollutant during both wet and dry seasons. A survey of the level of the water table indicated that the fluctuation was not more than two feet at any time. It was also determined that the water table was presently at a high point due to the spring snow and rain.

Working below the water table presented many construction problems for the engineers. The problem of how to place the concrete pads for the five manholes was solved by digging sump holes adjacent to the work area which carried the water away. The soil was then compacted and the pads placed. These sumps were continuously



HOLE
N (GERMAN)

TYPICAL CROSS SECTION OF A FRENCH DRAIN



pumped by using a submersible sump pump.

Due to the previous attempt to solve the problem, there were areas where the French Drain had to be placed in existing ditches which were full of polluted water and mud. By installing the POL separator first and working back from it, the polluted water in the open ditches could be pumped into the pipe. This allowed the pollutant to be collected by the separator. Earthmoving equipment was used to remove the three feet of mud in the bottom. Dry fill was then brought in and compacted to provide a base for the French Drain. As each section was completed, the water from another section was pumped into the pipe and the process repeated.

The usual spring rains caused some delay in the completion of the project, but this was kept at a minimum by only compacting the ditch in an area that could be completed and backfilled by the end of the working day. The duration of the project was 37 calendar days which was commended by the representatives of the city and the German Government.

The system began to work immediately. A large amount of fuel was separated from the water being pumped into the pipe during the construction phase. As sections were completed, water began to flow in the pipe continuously. After the last pipe was in place, a steady rate of flow developed and the separator had approximately three gallons of fuel in it per day. This fuel was pumped from the separator by the Facility Engineer on a daily basis.

Since it was impossible to determine the amount of pollutant in the ground, only broad estimates of the time required to remove the pollutant could be made. It was estimated that the major portion of the pollutant would be removed in the first year, with the remainder being removed in two or three years. Designed to operate indefinitely, the system will provide a lasting barrier should another spill or leak occur. These estimates were acceptable to the German Government.

The use of Army Engineers to solve this problem allowed the US Army to overcome a situation that caused a great deal of bad publicity and hard feelings with our host nation. A civilian contract for this system would have been more costly and the time of completion would have been delayed considerably. As a result of their outstanding work, 1st Platoon of C Company, 293rd Engineer Battalion, received an Engineer Command Outstanding Construction Award.

Captain William T. Maddox is currently Assistant Divisional Engineer, 1st Engr Bn, 1st Inf Div, Ft. Riley, Kansas. He holds a BS degree in engineering mechanics from the Univ. of Wisconsin and is a graduate of the Engineer Officer Advanced Course. His assignments include, Construction Platoon Leader, C Company, 293d Engr Bn, Baumholder, Germany; Adjutant, 293d Engr Bn; Aide-de-Camp, ADC-B 8th Inf Div, Baumholder, Germany; and Chief of Work Coordination, Facilities Engineer, Frankfurt, Germany.



DISPLAYING THE ITSCHNER AWARDS presented to them by Lieutenant General William C. Gribble Jr., are from left: Capt. Quinn D. Cloward, Commander, Co D, 1457th Engr Bn (CBT), Utah National Guard; Capt. David E. Spaulding, Commander, Co D, 802d Engr Bn, 2d Engr Group, 8th US Army, Korea; and Capt. Glenn L. Campbell, Commander, Co B, 456th Engr Bn (CBT), 99th ARCOM, 1st US Army (Pennsylvania).

The Itschner Award

CPT Richard B. Polin

The Emerson C. Itschner Award is awarded by the Society of American Military Engineers (SAME) to the engineer company which best symbolizes the character, mission and performance of the Corps of Engineers. The award, presented annually at the Engineer Dinner at Ft. Belvoir, is named in honor of LTG Emerson C. Itschner, a former Chief of Engineers and past president of the society.

One of the aims of the award is to promote leadership in junior officers and to foster "esprit" in company sized engineer units. For the purposes of the competition, company sized units include all engineer numbered and lettered or headquarters companies, separate or belonging to a battalion, brigade, group or larger organization, and activated under a TOE/TDA. In the past, the award was limited to active duty units. In 1974, the competition was expanded, providing separate awards for both National Guard and Reserve units.

The winner, active Army, for calendar year 1974 was Company D, 802d Engr Bn, 2d Engr Gp, 8th US Army, Korea. The three runnersup were: 503d Engr Co (LE), 7th Engr Bde, VIII Corps, Europe; Company A, 92d Engr Bn, US Army Forces Command, Ft. Stewart, Georgia; and Company A, 4th Bn (Specialist), 4th Advanced Individual Training Bde (Engr), Ft. Leonard Wood, Missouri.

The Army National Guard winner was Company D, 1457th Engr Bn, Utah National Guard. The two runnersup were: Company B, 724th Engr Bn (CBT), Wisconsin Army National Guard; and Company B, 1092d Engr Bn (CBT), West Virginia Army National Guard.

The Army Reserve winner was Company B, 458th Engr Bn (CBT), 1st US Army (Pennsylvania). Runnersup were: Company C, 397th Engr Bn (CBT), 385th Engr Gp, 416th Engr Command, 5th US Army (Wisconsin); and Company D, 820th Engr Bn (CBT), 124th ARCOM, 6th US Army (California).

Although the designation of a single winner from a field of highly qualified finalists is a difficult chore at best, the Itschner Award Selection Committee would like to see more units compete for this award. The key to turning out a winner, in addition to having the qualifying credentials, is to adequately document the unit's activities over the course of a given calendar year. A company information specialist, armed with pen and camera, in conjunction with the various levels of local military and civilian news media, can go a long way toward enhancing the attractiveness of an already worthy endeavor.

It is true that some units, by virtue of their location or circumstances, have an advantage when it comes to the performance of tasks which

are apt to make the headlines. Nevertheless, it is equally true that an outstanding unit will perform its assigned missions in a most commendable manner at all times. General Bruce C. Clarke (USA Ret) once said, "The best unit in an organization is always the one which is excellent or best in all things." The description can be applied to any sized unit and strongly suggests that the measure of excellence is dependent neither on amplitude nor on prominence.

The award selection committee has recently submitted to SAME a proposed entry format to be used by next year's contestants. Although a new format has not been finalized, the following information can be used as a guide in preparing next year's entry.

The necessary information should be bound in a simple three ring folder or loose leaf notebook, and be compatible with the evaluation criteria discussed in the ensuing paragraphs.

The unit should provide a statement outlining its command mission. This is not to be confused with the general mission, as stated in TOE. Following this, mission accomplishments should be documented. Specifically, combat support tasks, construction tasks, and training and inspection results should be highlighted. Combat support, the crux of a combat engineer's mission, normally consists of engineer support of FTXs and other major exercises, to include the testing of supported units. Construction oriented combat support — the fabrication or maintenance of tactical facilities, is closely akin to construction support, which is simply the performance of engineer projects in general. In either case, these provide an excellent opportunity for engineer units to improve their "esprit de corps" while producing a tangible means by which their engineer skills can be realized and appreciated by supported units.

Training conducted should be listed by type — demolitions, river crossings, quarry operations, and so forth. MOS qualification programs should be discussed where applicable, with a listing of what the unit is doing to maintain high skill levels (i.e. night training, schools, etc.). Details of adventure training — a specific form of dynamic training, to include activities as rapelling, orienteering, cross country and survival exercises, should be discussed, as well as ATT/ORTT results, and any other innovations in training or management. Information such as results of inspection, should be well documented.

Types of professional Army programs being supported should be listed. Considered along these lines are: professionalism, Army life and enlistments.

- Professionalism: The unit should identify

its educational development program, to include GED tests passed, high school diplomas received, and college courses undertaken. Additionally, officer and NCO development programs should be outlined.

- Army life: The selection committee will be examining those accomplished actions which contribute toward bettering the unit's living conditions. For example, efforts to improve EM living conditions, development of mutual trust within the command, and the effectiveness of ongoing programs such as human relations, equal opportunity, drug/alcohol abuse, and crime prevention.
- Enlistments should be categorized as either first term or career reenlistments.

Another area of consideration is welfare of the command. Here the unit should discuss its safety and accident prevention program, to include the number of reportable military accidents and miles driven, the number of reportable personal injuries, and the status of the Occupational Safety Health Act program. Additionally, the AWOL and Court-Martial rates will be analyzed in order to help determine the maintenance of good order and discipline within the organization.

The selection committee will also review the unit's contributions to the image of the Corps of Engineers. Community relations programs, especially with respect to improving the environment; domestic action programs; and any other unique contributions, such as recommendations for changes to doctrine, will be considered.

Two broad and significant areas of concern are: contributions to Army goals and unit affiliations (i.e. Army National Guard, Reserve, Allied, etc.), and the major commander's evaluation.

Finally, it should be emphasized that proper documentation of these, and any other reportable activities throughout the year, can go a long way toward meriting serious consideration for the Itschner Award. While it is true that actions speak louder than words, it must be remembered that the preponderance of outstanding engineer units around the world only serves to increase the difficulty of choosing "the best." The annual presentation of this coveted award provides a means of revitalizing the competition and renewing the challenge. How does your unit stand against the others? You can find out in 1975.

Captain Richard B. Polin is presently enrolled in a graduate program at George Washington University. He earned a BSCE degree from Lafayette College and is a graduate of the Engineer Officer Advanced Course, 1-75. He has served previously with 12th Engr Bn, Germany and US Army Engineer District, Far East, Korea.



Colonel Charles E. Edgar III

We have all, from time to time, received a letter advising of a new assignment. It frequently concluded with the often repeated phrase: You will find this assignment to be both challenging and rewarding.

It is true sometimes the job lives up to its billing, while on other occasions, it does not pan out quite the way in which it was anticipated. What follows is my attempt to share with you an insight into an assignment which falls into the former category. Specifically, my purpose is to tell you about the challenging and rewarding assignment to the United States Army Engineer School (USAES); what is going on here; what it means to you, the Corps and the Army and to urge you to seek duty here at the "Home of the Engineers."

Before discussing assignment to the USAES, one cannot talk about the Engineer School without considering the rest of the Engineer team here at Fort Belvoir, all of whom contribute today toward making Colonel William Fairfax's former property, truly the "Home of the Engineers". The specifics of assignment to the Engineer Center are worthy of separate treatment and will no doubt be addressed in a subsequent issue of *The Engineer*. Suffice it to say now that the school and the center are equal partners in the efforts here at Fort Belvoir to produce and train the best Engineer possible to meet the needs of the Army.

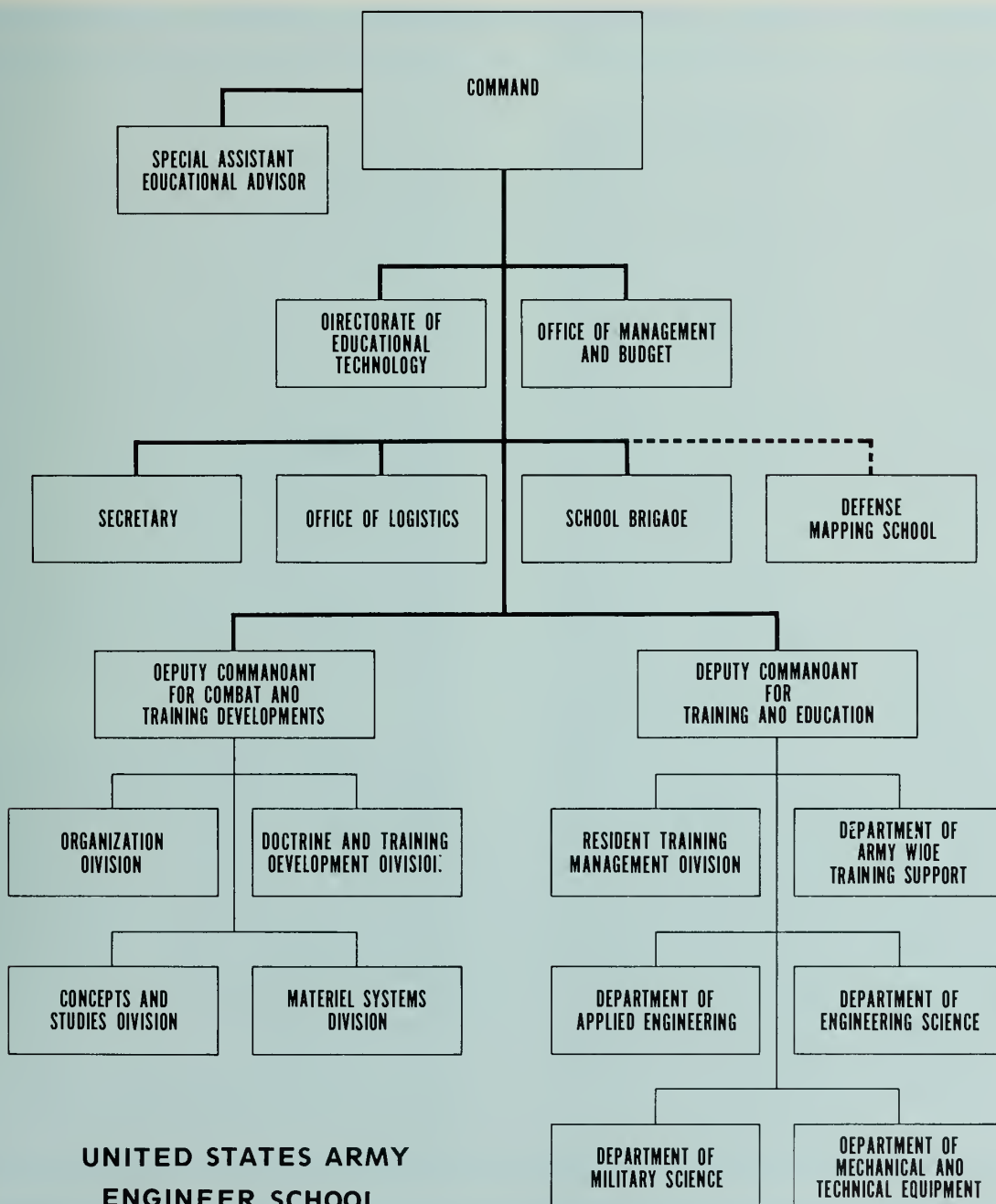
The USAES's story really needs to be told to our Engineer community because if you were like me prior to my assignment here, your knowledge, too, was limited and you basically had a "student view". That is, you attended the Engineer Officer Basic (EOBC) and Engineer Officer Advanced (EOAC) Courses. If this describes you, you are far from alone because I have found this true of most engineer officers. Alternatively, you might have had a previous assignment here on the staff and faculty. In either case, that experience is probably your perspective of USAES and that is where it ends. What's more, and which is not well known is that the student or former instructor perspective is only the tip of the iceberg in the total of activities currently taking place at USAES. These activities are at the same time interesting, exciting and far-reaching. In many instances, they are also dynamic and always there is the challenge. The challenge . . . Your reaction at this point probably something like — "Oh really, at Belvoir, the Engineer School . . . Why I remember . . ." Yes, we all remember. However, we remember the way it was — not the way the USAES is today!

The USAES mission assumed new proportions with the reorganization of the Department of the Army staff. The Directorate of Military Engineering and Topography, Office of the Chief of Engineers, was eliminated and its functions distributed to other organizational elements of the

Department of the Army. Additionally, the Combat Development Command, with its Engineer Agency, was deactivated. As a result, the USAES assumed new and increased mission responsibilities. As such, the Engineer School is now the fountainhead of military engineering within the Army. This encompasses both formal professional development and skill progression training, as well as the responsibility for combat developments, to include concepts and materiel system development. Thus, the mission of USAES is not only to educate military engineers but also to develop the doctrine which guides our whole reason for being — namely support of the Army in the field.

In order to accomplish our mission, we have a Deputy Commandant for Training and Education (DC/T&E), a Deputy Commandant for Combat and Training Developments (DC/CTD), a School Brigade to provide administrative support and control for the staff, faculty and students, plus the requisite administrative staff to provide comptroller, logistical, educational and liaison support. This organization is outlined in the chart below.

From the chart, it will be noted that the Defense Mapping School (DMS) is under the operational control of the Commandant. DMS, commanded by an Engineer officer and staffed



by all the military services, is an activity of the Defense Mapping Agency. It provides instruction to USAES students formerly taught by the old USAES Department of Topography.

Despite the changes, the heart of our mission here at USAES remains to provide well trained and educated engineer soldiers. This can be divided into two major parts—the resident curriculum and Army Wide Training Support (AWTS). The DC/T&E provides 30 resident courses of instruction: 13 are professional development, 14 skill progression and 3 functional.

The professional development courses are designed to prepare commissioned officers, warrant officers and noncommissioned officers to effectively perform the duties required in assignments of progressively greater responsibility, (e.g. EOBC, EOAC, ENCOB, ENCOA).

Skill progression courses train military personnel in skills related to a specific MOS (e.g. Engineer Equipment Repair Technician, Soils Analyst and Power Pack Specialist). Functional courses complement both professional development and skill progression courses by enhancing the individual's effectiveness in selected areas (e.g. Atomic Demolition Munitions and Facilities Engineer).

The magnitude of the resident curriculum is considerable: some 11,000 students were programmed in FY 75 and 333 classes were required to satisfy the programmed input. The second major part of the T&E mission, Army Wide Training Support, has key programs associated with it, many of which are Reserve and ROTC oriented. It is in the Department of Army Wide Training Support that nonresident instruction is conducted. Some 22,000 students representing the different branches of the Armed Forces, Federal agencies and foreign nations were enrolled during FY 75, an increase of 7,000 over the previous FY. USAES mobile training teams frequently visit USAR schools, units, posts and ROTC units. General Officer Reserve Component seminars, commander's conferences and other programs are actively pursued under this mission here at USAES. Our Army Wide Training Support is dynamic and is recognized within the TRADOC community as materially contributing to total Army force readiness. The real significance of this statement comes home when one realizes that 70% of the engineer force structure is found in the Reserves. Forty Nine Engineer Battalions are in the active force while 101 are in the reserve.

The Combat and Training Developments (CTD) mission has come a long way and has expanded much since its return to USAES. In fact, it is still growing as a result of a variety of initiatives.

There is constant and continuous discussion and coordination between developer and instructor. The ideas of both are "key" in the total development and training products are improved as a result of such discussion and exchange.

Many and varied programs comprise the CTD mission. The organizational development program has as its objective the keeping of all engineer TO&Es current, (some 90 in number) as well as developing new ones as required by new equipment, doctrine and concepts. The Material Development Program concerns itself with new and improved engineer equipment and its operational test and evaluation. Training development deals with both individual and unit training. The former includes the development of MOS job descriptions and testing — key features in on going Enlisted Personnel Management System (EPMS) development. The latter includes the determination of procedures and techniques that serve to increase the effectiveness of unit training, such as the Army Training Evaluation Program (ARTEP) and Training Extension Courses (TEC). The training literature of the USAES (we have proponentry for some 195 publications), includes development and/or revision of FM's, TM's, TC's and "How to Fight" manuals and pamphlets. Significant recently was the TC publication which detailed the concept for employment of the Engineer Combat Battalion (Heavy), portions of which were reprinted in the Winter-Spring issue of *The Engineer*. This battalion's TO&E was also developed at USAES. The studies program encompasses in house and contract studies and provides supporting input to the studies of other agencies insofar as engineer impacts are concerned. These efforts covered a wide spectrum to include the Scenario Oriented Recurring Evaluation System (SCORES), a key feature in the TRADOC study community, to engineer cellular teams.

The above outlines much of what is going on here at USAES. What does it mean to you as an engineer in the United States Army? What it means is simply this: What the Engineer School does, or fails to do, will affect you personally throughout your career, the Corps professionally in its ability and capability to support our Army and the Army in its mission to defend the nation. Thus, all of us have a stake in the USAES product whether the product is the graduate, a document or a piece of equipment.

The challenge is here at USAES — both personally and professionally. What ever or wherever your interests may lie, whether you are an officer or noncommissioned officer, what goes on at the Engineer School affects you and if you wish to influence the action of the Corps of

Engineers and indeed certain aspects of the Army, you should fight to be assigned here. As an instructor you can personally put your stamp on literally hundreds of resident students, both officer and enlisted. This opportunity presents you with an ideal and meaningful way in which you can use both your own field experience plus any special academic education you may have received in any of the many disciplines pursued by Engineer officer and enlisted students. Personally, you can experience the professional stimulation that comes from exposing your thoughts and ideas to the analysis and criticism of others. Furthermore, what better chance is there to get surfaced and possibly adopted than those set techniques you learned in "the school of hard knocks?" We especially desire instructors who have not only the technical expertise but also the practical experience of having led at the squad, platoon, company, battalion and group levels.

If your druthers lie more in the field of R&D, force planning, personnel management or writing fields, you can easily find a meaningful and productive home in CTD. Assignment here is exciting, difficult and demanding. The Family of Scatterable Mines (FASCAM), Ribbon Bridge, Fuel Air Explosive (FAE), Family of Military Engineer Construction Equipment (FAMECE) and the Medium Girder Bridge (MGB) are some examples of CTD's involvement in materiel systems development. The concept of employment and the basis of issue of these and other items reflect the USAES imprint. The Corps of Engineers is proponent for some 32 officer and 63 enlisted MOSs. Many of the latter are under consideration for consolidation under EPMS. It is in this endeavor where those who wish to plow new ground in personnel development and training will find their nitch.

For those who seek the challenge of troop command, service in the USAES Brigade provides a testing of all leadership qualities. The Brigade comprises three battalions, which includes command of both staff and faculty, officer and NCO students, as well as Advanced Individual Training (AIT) enlisted men and women.

The impact of the USAES instructor or developer is far-reaching in every sense. This assignment is, in fact, a grave responsibility. Development for the future and teaching the principles of military engineer professionalism are tasks that cannot be taken lightly. If there is one lesson our Army has learned time and time again in the wars we have fought, it is that we owe our success to the professional education of our officers more than to any other single factor. As our doctrine was evolved, it was thoroughly

taught to our junior leaders. Our officer professional development courses have provided the proof of the pudding. As a result, a similar program is now in effect for our most outstanding noncommissioned officers (NCO). This expansion of a proven cycle must continue to be strengthened and improved. Experienced, mature instructors and developers are essential if we are to achieve success on the modern battlefield, which is ever increasingly complex and dynamic. It is a fact of life that the product of our officer and NCO professional development courses will influence the combat engineer support and, indeed the combat operations, of the Army for years to come. In today's smaller professional Army, we cannot afford to produce an inferior quality officer or NCO graduate. If war comes, we must win the first battle.

The foregoing provides only a window to view just some of the ongoing activities here at USAES. A complete list would be too numerous to mention in this reading. We here at the Engineer School encourage you to write or call us if you have questions about assignment to USAES. The challenge is here at Fort Belvoir. There is responsibility, room for individual initiatives, the opportunity to personally influence the future of the Corps in both officer and enlisted ranks, as well as the equipment we will use and the doctrine we will follow in its employment. Lastly, there is the reward: knowing you have contributed to making a better Corps of Engineers to support the Army in the field. No true Engineer can ask for more or do less.

Colonel Charles E. Edgar, III is currently the Executive Officer, USAES and will become the Little Rock District Engineer in late July. Since being commissioned as a Distinguished Military Graduate from the Virginia Military Institute in 1958, he has served in a variety of command and staff assignments to include the 237th Engr Bn (Combat) in Germany; Battalion and Group Advisor duty in the 6th Engr Gp (Const), ARVN; Chief, Education Section, Engr Branch, OPD; Engineer Plans Officer, I Field Force Vietnam and as a staff officer in Strategy and Policy Branch, Plans Division, ODCSOPS, DA. Col Edgar commanded the 577th Engr Bn (Const) in Vietnam. He has served as an Area Engineer, Louisville District and in OCE as the Executive Officer, Civil Works and the Assistant Director, Civil Works, Lower Mississippi Valley Division. His civilian education includes Bachelor (VMI) and Masters (Iowa State University) degree in Civil Engineering. He is a graduate of the USAES, the CGSCC and graduated with distinction from the Naval War College. Col Edgar is a Registered Professional Engineer.

O E R S



LTC Leslie H. Savage

If the Chief of Staff, Army, knew every officer on active duty well enough to evaluate his/her manner of performance and potential, there would be little need for the Officer Evaluation Report (OER) system. Unfortunately, the size of our Army precludes this and some type of evaluation system is therefore required to determine how well, or poorly in some instances, an officer is performing his job. Despite the Army's efforts to devise an optimum system, such a goal continues to elude us and the present OER (DA Form 67-7) is no exception. However, it is extremely important that personnel performance be evaluated objectively and that the OER system be responsive to both career development and selection boards. Why is this important? There are two important reasons:

- The OER system is designed to accurately reflect the manner of performance of specified duties, over a rated period, in a form readily usable by Department of the Army

(DA) selection boards and career branch personnel.

- The entire efficiency file is reviewed by branch personnel managers for all personnel actions. Although education (civilian and military), experience, availability for reassignment, and skills are important, the OER remains the most important single document in an officer's official personnel records.

Given the above frame of reference, the standard question consistently asked is, "How can I influence the personnel system?" The answer is predicated upon how well a series of raters, indorsers, and reviewers evaluate your job performance. In other words, your OER should be a reflection of your "total performance." If you are a rater or indorser, it is your responsibility to provide both DA and the rated officer an accurate evaluation of both performance and future potential. The manner in which we undertake this objective analysis helps determine the total effectiveness of the OER system. An applicable

variation of the Golden Rule might well be: raters and indorsers should exert the same painstaking care in the completion of OERs on subordinates that they would expect in the preparation of their own reports.

A review of the large number of OERs, received at MILPERCEN during the past year, reveals that this rule is frequently violated or ignored. The first principal weakness is found in the narrative portions. Narratives are extremely important and provide the reader an insight as to special duties, professional attributes and overall degree of performance. In this regard, two sections of DA Form 67-7, Part III (Description of Duties) and Part VII (Comments), are extremely important. Clearly, we cannot expect an Armor or Infantry colonel sitting on a promotion board to be familiar with the duties of a company commander of a light equipment company; or of a resident engineer of an Engineer District; or of any other unique Corps of Engineers job. Therefore, it is essential that the specific assigned duties be clearly delineated (Part III provides for this) to include the magnitude or level of responsibility. However, Part VII of the DA 67-7 Form, presents a real challenge since previous OERs (DA Forms 67-5 and 67-6), had no space restrictions thereby permitting narratives to be expanded on additional pages. Raters enjoying an ease of facility with the "Queen's English" were frequently able to transform average performance into something that would do justice to the General Officer Corps. This ability to articulate often resulted in a distorted image of an officer's ability and/or performance, and placed an additional reading burden on the tight of selection boards.

By contrast, DA Form 67-7 restricts comments to the space provided on the form. The rater and indorser, stripped of the potential for substantial verbiage, must therefore write concise, succinct statements describing an officer's manner of performance. Unfortunately, some rating officials have not matched the challenge, in that, they manage to utilize the space with less than substantive evaluations, and with information of limited use to personnel managers and selection boards. For example, the following comments described a lieutenant serving as S2 of a combat engineer battalion: "This officer performed a variety of tasks with considerable skill and within specified parameters. He was always pleasant in my presence. He supported the Equal Opportunity Program." Another comment described a captain who commanded an engineer construction company. It read, "This officer demonstrated competence and professional judgement in accomplishing the myriad of related and unrelated requirements placed on his unit." Were these

good narratives? Compare the two previous comments with that of an indorser who described one of his company commanders: "This officer is the most outstanding company commander in the group which consists of nineteen engineer companies. He is head and shoulders above his peers. His company consistently excelled in every project and mission assigned to include several extensive periods of engineer support to an infantry brigade operation." In a few succinct, but illustrative sentences, this indorser additionally described three specific projects accomplished by the unit. Anyone reading this OER has a clear picture of the respective officer's performance and potential. The real challenge is to rate an officer whose performance has been average. Selection Board members must be able to determine the most deserving for promotion or selection for school. Accurate and comprehensive ratings can be more easily accomplished if the rater is objective and makes clear and concise observations.

In summary, the success of any evaluation system depends on the combined efforts of the officer corps. How much time did you spend on a subordinate's OER? How well did you really describe his manner of performance? Were you guilty of being vague and verbose, or did you write clear, simple statements telling *what* the officer did and *how well* he performed the assigned job?

In conclusion, there is no document more important to a military officer than the OER. As such, it is the keystone for career development, promotion, selection for schooling, separation, and other personnel activities, all of which greatly affect an individual's career. Bearing that in mind, each of us should give the same consideration, time and thought to the writing of an OER as we would expect of those who prepare our report. The officer corps deserves nothing less.

Lieutenant Colonel Leslie H. Savage is Chief, Personnel Actions, Combat Support Arms Division, Officer Personnel Directorate, US Army Military Personnel Center. He is a 1958 graduate of the Virginia Military Institute where he received a Bachelors Degree in Civil Engineering. He also earned a Masters Degree in Civil Engineering from the University of Illinois. His military education includes the Engineer Officer Advanced Course, Army Command and General Staff College and the British Army Staff College. He served three tours in Vietnam to include 18 months with the 65th Engineer Battalion, 25th Infantry Division. Other assignments include the 168th Engineer Battalion, the 32d Army Air Defense Command and Commander, 82d Engineer Battalion in Germany.

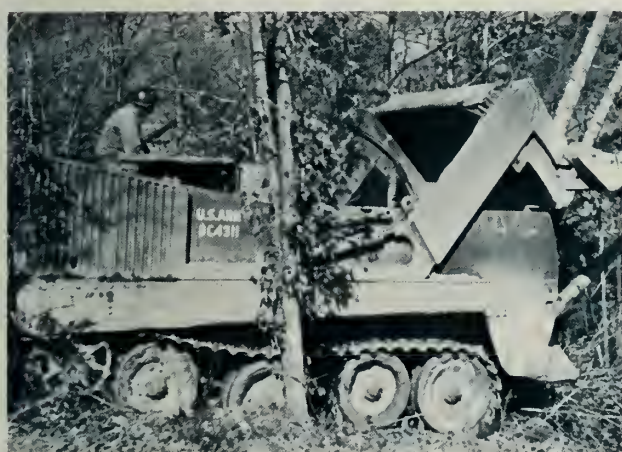


MOBILITY AND THE CONTEMPORARY UET

Robert W. Harrington

The mobility doctrine has its foundation in the principles of war. One of its salient doctrinal precepts is that combat support units should have mobility which equals that of the units they support. Thus, combat engineer units must be sufficiently mobile to provide combat support in the ground gaining environment of the forward battle area. It is this precept which has provided the impetus for the development of the Universal Engineer Tractor (UET). The UET, as it is commonly known in the "engineer family," has

been under development for many years. The current requirement for the UET is stated in paragraph 636c(5) of the Army's Catalog of Approved Requirements Documents. This requirement is for an armored, amphibious, combat engineer tractor having the capabilities of dozing, rough grading, excavating, hauling and winching; capable of being air transportable and assault aircraft landed; and having high mobility. The tractor will be the principal item of earthmoving equipment for divisional and corps combat



engineer units and will replace the crawler tractors in these units. Additionally, the UET will provide an increase in hauling capability and a scraper capability not presently organic.

The development of the UET has spanned many years and undergone four generations of prototype evaluation. A search of the "archives" establishes 1958 as the year in which the engineer R&D community decided to embark on a program to develop a UET. Industry bids had been solicited earlier by the Mobility Equipment Research and Development Center, Ft. Belvoir, VA, (formerly Engineer Research and Development Laboratories) for the forerunner of the UET — a rubber-tired ballastable airborne tractor to fulfill the needs of airborne engineer units. Following this initial effort were feasibility studies, an industry proposal for a ballastable crawler scraper-dozer, prototype fabrication, and the eventual drafting of military characteristics which were to guide a materiel development program.

The above efforts were followed by a frustrating period for the materiel developer. Within the Army there were divergent views on what the UET should be. Innumerable reviews and assessments were made of the program, but no firm

requirement or program was forthcoming. Although initial approval of the military specifications was obtained in 1960, revisions to the requirement were pending at all times during the development stage until the approval of the Qualitative Materiel Requirement (QMR) in 1965. Even though many of the changes were major, the basic tractor remained the same. For example, the tractor was originally intended as an earthmover for use by airborne engineer units. The emphasis was then changed to that of a squad vehicle for use by other combat engineer units as well as airborne units. Subsequently, a requirement was added for armor protection for the operator and lateral protection for troops being transported in the bowl of the UET. However, the years went by without a UET.

Why then has it taken so long? There are many reasons. It will be too lengthy to explore each of these adequately within the scope of this article. However, two observations are particularly germane. First, the differing opinions on the need, capabilities, utilization and technological approach to the UET meant that a firm requirement was not established until the initial development of the item was nearly complete. As previously stated,



CARGO CARRIER



PRIME MOVER



DUMPER

the QMR was not approved until 1965, making it an after-the-fact occurrence rather than providing a coordinated guide for the development program. Secondly, and perhaps of greater importance, was the lack of a viable materiel development management program to firmly establish user requirements, to clearly define these requirements to the developer and to industry, to provide for con-

tinuous monitoring of hardware development and testing, and to institute the degree of management discipline necessary for timely decision making.

The present UET is intended to provide combat engineer units, especially those in support of mechanized and armored units, with a versatile tactical earthmover possessing essentially the same mobility as vehicles of the supported units. The UET is designed to travel light and work heavy in keeping with mobility requirements. It features a front loading scraper bowl and a hydraulically operated apron with a positive load ejector. The dozer blade, which is integral to the scraper apron, is hinged and can be folded to increase the angle of approach when the tractor is used as a transporter. The engine and power train are in the rear of the tractor. The UET converts to an armored vehicle without attachments by closing an armored hatch which is normally stored behind the operator, who is the only crew member. For general construction work, a windshield and canvas soft top can be installed. Dozing and scraping are accomplished by raising and lowering the entire front of the tractor by means of the hydropneumatic suspension system, rather than by independent operation of the blade and bowl. At the option of the operator, the suspension system of the UET can be quickly positioned for a smooth, fast, resilient ride over uneven terrain, or made rigid and tiltable for slow-speed maneuverable dozing, excavating, loading, pushing, or towing operations. Tree felling is accomplished by raising the apron, and consequently the dozer, to obtain additional leverage. Although the UET weighs only 32,000 pounds, its work capability for bulldozing operations can nearly be doubled by loading the scraper bowl with earth ballast, thus increasing the tractor's gross weight by approximately 20,000 pounds. Moreover, the open bowl, front loading configuration is exceptionally well suited for self-loading, transporting and unloading of palletized loads, barrier materials, or other items needed to support combat operations. In addition to its ability to perform bulldozing and scraping functions, the UET can also function as a haul vehicle capable of speeds up to 30 mph. This mobility enables the UET to move individually and rapidly from job to job, on-road or cross-country, as well as move in convoy without the need for truck-tractor and semi-trailer support. The UET has the capability of crossing inland waterways by floating and propelling itself with its tracks. This limited swim capability in calm water is equal to that of the armored personnel carrier, M113. However, before amphibious operations, a seal must be installed on the scraper apron; this requires about 15 minutes. With the bulldozer blade, the UET can prepare shore entries and

exits for other amphibious vehicles — for example, in the assault phase of river crossing operations. It can also wade and work in water too shallow for swimming. Using its winch, the UET can assist other vehicles in crossing obstacles and for recovery operations.

Although it can be employed in airborne operations, the UET is intended for use mostly, but not exclusively, by combat engineers in support of mechanized and armored units and will replace the crawler tractors as well as their transport vehicles in these units.

Another potential use of the UET is "digging in" of field artillery for firing batteries. In 1973, the Field Artillery School informed the USAES that, in their opinion, earthmoving equipment presently in the inventory did not possess the mobility characteristics required to support artillery units in the fluid battlefield environments postulated for the future. As such, they expressed an interest in the UET, and, in conjunction with the USAES, will monitor future testing to aid them in determining the suitability of the UET for field use.

Since late 1964, the UET has undergone extensive engineering and service testing by the Army's Test and Evaluation Command (TECOM), Aberdeen Proving Grounds, MD., in which military utility and functional performance were demonstrated. Test reports concluded that the UET performed its earthmoving and hauling functions in an outstanding manner — when it was operational. However, failure to meet reliability, durability, and maintainability requirements have precluded its acceptance for use by troops in the field. The Army Materiel Command (AMC) conducted a Development Acceptance In-Process Review (IPR) on the UET in October 1969. The materiel developer's position to accept the UET was not agreed to by the other three voting members (USACDC, USACONARC, and LDSRA). The major point of disagreement concerned the improvement in reliability that could be expected through increased quality control and hard tooling in quantity production. Since this was essentially a technical question, the four IPR members recommended to Department of the Army (DA) that an *ad hoc* group of the Army Scientific Advisory Panel be presented the UET problem for review and formulation of recommendations for future efforts.

The present development program for the UET is in accordance with the program plan recommended by the *ad hoc* group in their report to DA in 1970. A product management office has been established within AMC that has total program responsibility for completion of development and initial production of the UET. An updated QMR

was approved by DA in 1971. Independent reviews of the UET drawing package and previous TECOM test reports was accomplished by awarding competitive shakedown and evaluation contracts to two firms with considerable experience in the production of high speed tracked vehicles. Each firm was furnished with a rebuilt prototype and all design data to assist them in their development of proposals for redesign, component testing, fabrication of prototypes, conduct of in-house testing, and support of TECOM acceptance check test. As a result of the proposals received, an Advanced Production Engineering contract was awarded to Pacific Car and Foundry Co., Renton, Washington, for accomplishment of the above tasks. As of this writing, the fabrication of four UET prototypes is complete and contractor shakedown testing is in process. Upon conclusion of this test phase, scheduled for this summer, the UETs will be shipped to Aberdeen Proving Ground, MD., where each tractor will undergo 650 hours of acceptance check testing. The primary objective of the check test is to demonstrate reliability and durability improvement and to reaffirm the performance and mobility data obtained from earlier TECOM tests.

Improving the low reliability of the UET is a formidable task. The UET is more complex than any of the single purpose construction vehicles presently in the engineer inventory. Mobility and good performance at both high and low speeds has never been accomplished in a tracked construction vehicle prior to the UET, and complexity has been the result. Since reliability generally is a function of the total parts and components of an end item, the added components present another factor that makes the UET reliability goal difficult to achieve. If the check test demonstrates that reliability and durability have improved to a level which the Army can accept, then the UET may be adopted. If the UET survives and is adopted for Army use, production should begin in 1977 — 19 years after the program first saw the light of day! Only field operational use will tell us if it was worth waiting.

Mr. Robert W. Harrington is assigned to the Engineer School, Deputy Commandant for Combat and Training Developments, as an operational test and evaluation project officer with the Materiel Systems Division. His previous assignments were with the Department of Mechanical and Technical Equipment where he was involved in developing training courses in the operation, maintenance and repair of engineer missile support equipment for US and foreign military students, and with the Engineer Agency of Combat Developments Command as a project officer for test and evaluation of airborne and airmobile construction equipment.



CHAPEL OF HOPE

PFC Barbara Long

The construction of a complete chapel is a major project for any construction company, either military or civilian. The men of the 983d Engineer Battalion (Construction), who meet only one weekend a month, undertook such a challenge. Teachers, factory workers, store clerks, and accountants became carpenters, masons, electricians, and plumbers for two days a month.

The construction of a chapel was one of the most unique and challenging projects ever to be



undertaken by this battalion. It was the first project of this magnitude ever to be completely designed and developed by military units for civilians in this area. Up to this point, the battalion had only been involved in civilian projects which did not require the expertise of all the construction trades.

The "Chapel of Hope" is located on a wooded site at the Maumee Youth Camp. This is a State operated juvenile corrections facility located near the rural northwestern Ohio village of Neapolis. The American Gothic Chapel consists of a sanctuary which seats 100 people, classrooms, a general purpose room, storage and utility rooms, two rest rooms, and two offices. It even has stained glass windows, donated by a century old church scheduled for demolition.

The chapel serves delinquent boys, ages 10-15, who are first time offenders. They are able to attend non-denominational church services, Sunday school, and "Y" meetings in the chapel as well as a host of other activities.

The battalion became involved in the chapel project at the request of the Maumee Youth Camp Chaplain. His attempts to raise adequate funds fell short of his needs — to build a spiritual center for the young men at the youth camp. Undaunted, the Reverend and his Volunteer Council (a group of civic minded business people) decided to contact the 364th Engineer Group and explained their plans to the Group Commander. The 364th then prepared the plans, incorporating materials which would be donated or purchased and therefore stay within the available budget. The plans for the chapel were prepared with the assistance of a local consulting architect. All plans were submitted and approved by the State of Ohio Architect's Office prior to construction.

The actual construction of the chapel by the 983d Engineer Battalion began in Spring 1974. Reservists from two Toledo, Ohio, based companies and the company based in Bryan, Ohio, worked on the chapel a total of three week-ends a month.

This battalion had never before undertaken so vast a project and the consequences proved very beneficial. For example, the battalion construction officer noted an improvement in the performance of the men when they were able to see the purpose of their efforts and took a sense of pride in the tasks they were undertaking. Instead of just studying their trades in the classroom or on small projects, the men of the 983d constructed a chapel for the less fortunate youth of their own community. The reservists view the chapel as a chance to improve their construction skills and at the same time benefit the community.

Two-thirds of the men working on the chapel

learned their construction skills while on active duty. Most of the men do not practice these skills in their civilian occupations, and the chapel project gave them an opportunity to put these talents into practice. It also provided on-the-job training for men who were currently being trained by the Army Reserve as construction specialists.

An added benefit of the project was the public interest and civilian cooperation it generated. A Woodville, Ohio, based heating and plumbing company seized the opportunity the chapel project gave them to help the Reserves in their efforts to provide a much needed facility for the boys of the Maumee Youth Camp. Another local civilian — an instructor at the Penta County Vocational School, assisted with technical problems in stone masonry and once the project got underway, other willing and resourceful civilians added their support. This type of civilian-military cooperation is unusual for projects undertaken by the Army Reserves. It was the civic nature of the project which spurred members of the community to volunteer their time and talent.

Numerous reservists also put forth extra effort on the chapel project and stepped up to the tremendous challenge of constructing an entire chapel. Rather than spending their week-ends and summer camps on remote chores, they spent their time on a project of which they and their families can surely be proud. It isn't often that reservists can take a Sunday drive with their families and show them a building they built. The chapel is tangible proof of the energy the men have expended on a meaningful project.

Since the Maumee Youth Camp is under the jurisdiction of the Ohio State Youth Commission, the land for the chapel was donated by the State. Materials were provided by donations from the camp's Volunteer Council. The labor, of course, was provided by the 983d. According to the battalions construction expert, the Reserves provided services worth over \$40,000. The Reverend is quite aware of this and unhesitatingly adds, "Without the efforts of the Reserves the construction of the chapel would have been impossible."

The chapel was recently dedicated and is now a living monument to the volunteer efforts of the 983d Engineer Battalion.

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The Corps of Engineers has undergone numerous changes over the past two decades. Guiding the direction and rate of change is the central concept of leadership. General Bruce C. Clarke, an outstanding military leader, gives us some food for thought in his article with respect to the key characteristics Engineer officers have displayed and must display if they are to continue in the proud traditions established by generations of Corps leaders. In these troubled and confused times, it behooves us to look back and reexamine some of our achievements and prepare ourselves for the defense needs of tomorrow.

The military engineer of today faces the challenge of the future from the vantage point of a proud heritage, firmly based on the traditions of accomplishment and leadership so well exemplified by great military engineers who loom large in the history of our country. Throughout its existence, the Corps of Engineers has been called on to perform an amazing variety of duties, in many fields of endeavor, often far removed from purely military activities. From its ranks the Corps of Engineers has always produced the man who was equal to the task. The list of the great is long, much too long to do more here than to mention a few.

The history of exploration and development of the West is filled with the names of Army Engineers — Lewis and Clark; Fremont, the "Pathfinder"; Dodge of the Union Pacific. Since early in the Nineteenth Century, Army Engineers have been charged with development of our rivers and harbors for navigation, and more recently with mitigation and control of floods. This brings to mind Humphreys and Abbot, Jadwin and Pick. Other names will always go together: Goethals and Panama Canal; Groves and the atomic bomb; Wheeler and the clearing of the Suez Canal; L'Enfant and the planning of Washington, D.C.; Thayer and West Point; Somervell and the Army Service Forces in World War II; Clay and the

THE MILITARY ENGINEER AND THE FUTURE

General Bruce C. Clarke

Berlin Airlift; — the list of great engineers and great accomplishments goes on and on. And from the Corps of Engineers have sprung many of our renowned combat leaders — Lee, Meade, Oliver, MacArthur, Hoge, and many others. All of these names are well known, as are their accomplishments. An examination of the common characteristics of these great leaders provides some clues to the needs of greatness.

All were men of a high order of intelligence and common sense. They were inquisitive and keenly alert. They had accurate minds, and were able to assimilate facts and arrive at realistic, practical decisions. All displayed the initiative and a sense of duty to seek out tasks, and to accept full responsibility for the accomplishment of their missions. They were good managers, able to grow to the size the job demanded. Above all, they were men of high ethics, and skilled human engineers.

High ethical standards are essential to the military engineer. Unswerving honesty, no matter how unpleasant the facts may be, is part of the tradition of the Corps of Engineers. However, honesty alone is not enough; it must be coupled with high moral standards, the awareness of what is right and what is wrong. The resultant — that which we call integrity — provides the basis for greatness of character. When duty requires it, many men face the possibility of death in combat

with high physical courage. But all too frequently, the moral courage to risk possible damage to their career for a rightful cause in peacetime is lacking in men of apparently great promise. The high ethical standards of a great military leader include the moral courage to face unflinchingly the risk of a blighted career in the cause of that which he believes to be right.

Human engineering, the ability to organize, manage, inspire, and lead people, cannot be over-emphasized in the catalogue of common attributes of great military engineers. True, they had to have a superior knowledge of the theory and techniques of engineering, but they would never have risen to this high estate had they not been able to inspire and direct the efforts of others to get the job done.

The role of the military engineer in the future has been discussed and examined at length. Estimates range from "We won't need him" to "He will be the most important member of the force." Obviously, the truth lies somewhere between. To those who believe that the role of the military engineer is diminishing in importance, it may be well to point out that each of our country's wars has demanded more of the military engineer than did the preceding war, and that in each of our wars, the engineer force was a larger part of the whole force than it was in earlier wars. The future holds many challenging problems for the military engineer. The traditional role of enhancing our mobility while impeding the enemy's requires better means of crossing natural and man-made barriers, and better means of slowing and stopping the enemy. Ways must be found to accomplish the many engineer tasks faster, better, and with fewer men. The ability of the Army to move in all kinds of weather or climate, and in all types of terrain, must be improved. And, as men move into space to the moon and to the other planets, the military engineer faces a host of new, exciting, and tremendously challenging tasks.

As long as men live, there will always be new worlds to conquer, new horizons to be developed, new projects to be completed. The future is bright with promise for the men of vision who will dedicate themselves to making their dreams come true. In the forefront of these is the military engineer.

Reprint from The Military Engineer, July-August 1961, subject: "The Challenge of Leadership".



NCOES

The Noncommissioned Officer Education System (NCOES) is an Army-wide program having two primary objectives: provide Army enlisted personnel with a program for educational and professional career development; provide each branch of the Army with professionally qualified noncommissioned officers. To meet the needs of the Corps of Engineers and its dedicated career enlisted personnel, the Engineer School has developed two progressive NCOES programs of instruction: the Engineer Noncommissioned Officer Basic (ENCOB) Course and the Engineer Noncommissioned Officer Advanced (ENCOA) Course.

The requirement for the NCOES stems directly from the basic needs of the U. S. Army for more effective leadership at all levels. The senior noncommissioned officer supervises or controls approximately 80 percent of the Army personnel resources. He is, therefore, the key man in the military management structure.

The continuing progress and success of our Army and the individual success of the NCO will depend in large part on his technical knowledge as well as his ability to effectively direct people toward an assigned objective. The noncommissioned officer has always been known as the "backbone of the Army"; however, there has until now been no structured program to provide for his continuing progressive professional development. Today's NCOES and tomorrow's EPMS programs recognize and bring into clear focus the challenges of today and the great need for enlightened leadership, personalized to the individual and the situation, and balanced by professionalism and confidence for *all leaders* regardless of rank or position.

Sergeant First Class William D. Johnson

On-the-job training is not only appropriate but mandatory for many tasks, and certainly there are many fine soldiers in the Army today doing an outstanding job who learned most of their professional skills by applying themselves on the job and gaining knowledge from their experiences. All too often this has been the only way to learn because there have been insufficient Army or civilian schools that taught the skills required. The Army now realizes, however, the need for progressive and continuing formal education of its career enlisted men.

The ever-increasing complexity of equipment and management structures, as well as the unique leadership problems inherent in an all volunteer Army, make the process of continuing education an absolute necessity. It must also be recognized that not only is professional military education, important, but your civilian education is equally important. The Army wants and needs well-rounded men. This is demonstrated by Army policy that requires a high school diploma or equivalent for promotions beyond the grade of E-5.

Who goes to NCOES?

To attend the Basic Course, you must be a member of the Active Army or of a Reserve component in grade E-4 or E-5, have an MOS evaluation score of 100 or more as it appears on the Enlisted Evaluation Data Report (waiver available) in the most recent MOS evaluation, and have been selected by your unit commander and higher commanders as applicable.

To attend the Advanced Course, you must be selected by DA. For every one NCO selected, two

qualified NCOs were not! (There are not enough allocations for the Advanced Course to accommodate all of the qualified people.) Are you the best qualified in your Career Management Field?

Ninety percent (90%) of the Basic Course students will come directly from their parent unit and return upon completion. Ten percent (10%) will be those students in transit, who will continue on to assignment upon completion. Seventy-five percent (75%) of all students selected for ENCOA will come from their parent CONUS unit and return to the same unit. The other twenty-five percent (25%) will attend enroute during a permanent change of station (PCS). All students are in a TDY status and not eligible for family travel to the school.

What They Learn

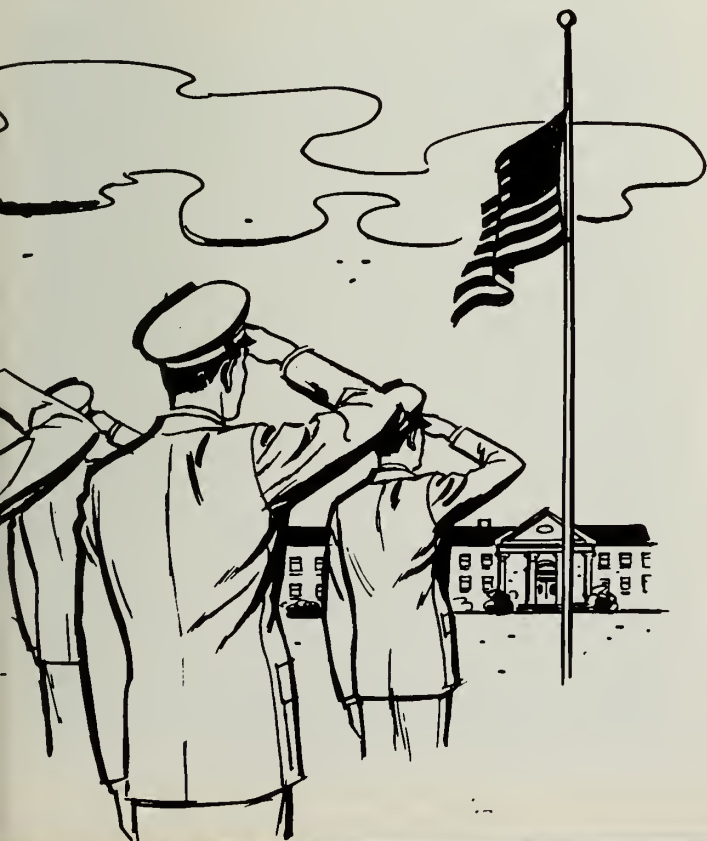
To accommodate all Engineer Career Management Fields and MOSs, the Engineer School has developed a course concept which is quite flexible and applies to both Basic and Advanced Courses. Each course is divided into four (4) phases — Phase I has a common time span and is that portion of each course that is applicable to all career fields. Phase II is the portion of each course devoted to specific career fields where subjects applicable to a specific career are presented. Phase III is that portion devoted to MOS specialization and instruction is aimed at increasing the skill level within the target MOS. Phase IV consists of specialized group and individual projects where the student will put to practical use the knowledge and skills gained during the

preceding weeks of instruction. For example, in the Basic Course, for the 12 series career field, Phase I consists of a general curriculum to include leadership, supply and maintenance procedures and material applicable to any MOS and career field. Phase II concentrates on combat engineering tasks to include equipment utilization, job management, tactical bridging, reconnaissance, construction operations, demolitions, and mine warfare. During this phase of instruction, students will receive cross-training of familiarity training within their Career Management Fields. Instruction in Phase III is MOS oriented, and for the 12B it might include advance techniques in camouflage, expedient methods of employing obstacles, rigging, field fortifications, demolitions, mine and countermining warfare, and other instruction unique to this MOS. Phase IV provides follow-up practical application of all the above instruction, utilizing individual and/or group study projects. For the 12B in Phase IV, a student might be given an introduction and mission to develop a target folder for the demolition of existing sample bridges; or to develop Barrier Plans with overlays for selected locations.

Phases II, III and IV all have variable lengths. The lengths of each are established according to the needs of the career groupings and MOS's and in line with the imaginative ideas that can be implemented for effective development training during Phase IV. The emphasis is on practical application and exercise of the student's initiative. One of the objectives of the Engineer School is to make all phases of instruction challenging and satisfying to the students.

In today's Army, with troop strength declining, the promotions and best assignments are going to be the reward of the man best qualified to do the job. Attendance at the Engineer Noncommissioned Officer Basic and/or Advanced Course will give you an opportunity to increase your professional skill, leadership, knowledge, confidence, and motivation.

SFC William D. Johnson is the Curriculum Manager for the NCO Basic and Advanced Courses, Resident Training Management Division, US Army Engineer School. He has served as an instructor at Fort Leonard Wood, Missouri, and the Combat Engineer Noncommissioned Officers Course (CENCO) in Germany. SFC Johnson served as a platoon sergeant and first sergeant with D Company, 299th Engineer Battalion (Combat) and is one of the very few enlisted men to command a combat engineer company in combat. He is a graduate of the Engineer NCO Advanced Course. His last tour of duty was as an Army Recruiter in Salem, Oregon.





COMMUNITY

LTC Howard J. Guba

A Helping Hands Story

As a result of mutual agreements between local communities and the US Army Infantry Center (USAIC), Ft. Benning, Ga., several significant community assistance projects have been undertaken by the 43d Engineer Battalion (Const). These projects have been accomplished in diverse communities in both Alabama—Cordova, Alexander City and Phenix City; and Georgia—Hamilton, Dalton and Columbus. Projects have included ball field complexes with ancillary buildings, extinguishing a major land fill fire, parks, roads and land clearing, and a major road complex with complete drainage facilities. The community assistance program is carefully monitored by the 36th Engineer Group (Combat) and the USAIC to insure that each project meets the following criteria:

- Sponsored by a non-profit organization for community benefit.
- No objection from local contractors.
- Materials and fuel are provided by the community.

Projects are evaluated from the viewpoint of overall training value for the 43d Engineer Battalion (Const), community impact, and support of

the recruiting program. Projects that best meet the above criteria are selected. One of the most significant community assistance project undertaken by the 43d Engr Bn (Const) is the Chattahoochee Valley Community College (CVCC) road project. This project, located at Phenix City, Al., will provide the required access road for a tract of land recently donated to the college. The scope of the project is listed in Table I. The overall project can be divided into the following phases:

- Clearing and grubbing
- Drainage
- Sub base construction
- Base course
- Curb and gutter

Initial effort began in August 1974 with clearing and grubbing operations. The project,

Total	Unit	Description
2	Acres	Clearing & grubbing, beyond R.O.W.
24,459	Cu. Yds.	Unclassified excavation
820	Cu. Yds.	Channel Excavation
203	Cu. Yds.	Foundation backfill, local material
1,224	Cu. Yds.	Unclassified culvert excavation
11,550	Cu. Yds.-in place	Granular soil base, class 1, type B
2,500	Ton-in place	Aggregate for base, class 3, and 5 roadmixed
213	Lin. Ft.	18" concrete pipe
275	Lin. Ft.	15" concrete pipe
129	Lin. Ft.	24" concrete pipe
480	Lin. Ft.	24" concrete pipe
198	Lin. Ft.	30" concrete pipe
96	Lin. Ft.	48" concrete pipe
2,000	Lin. Ft.	6" concrete s.p. underdrain
54	Lin. Ft.	Double 8' x 8' reinforced concrete
Curb and Gutter Lin. Ft.		13,675
Man holes ea.		20

ITY ASSISTANCE PROJECTS

which is 6460 feet long, was divided into segments. Responsibility for this was assigned to two companies. The earth moving platoons of both companies were almost continuously involved in construction, with only occasional excursions to high priority installation support and quarterly field training exercises. Inexperienced equipment operators rapidly learned the capability of their machines and improved their job performance through the day-to-day construction operations. The vertical platoons were involved in culvert construction which included a major cast in place double 8' x 8' x 54' reinforced concrete culvert.

Extensive framework was required, giving the carpenters valuable experience for future projects. The drainage plans included curb and gutters with brick drop inlets. The drop inlets provided valuable experience for the masons and also served as a proving ground for several Stripes-for-Skill mason personnel.

The presence of a swamp adjacent to the major culvert and several artesian springs located in a storm drain bed provided unique challenges to the platoon leaders and NCOs. To deal with the swamp, a coarse sand filter was sealed and the overburden placed. The desired stability was achieved and construction proceeded. Final paving was held over until major construction of college buildings was completed, thus allowing consolidation to continue and ultimately precluding differential settlement of the paved surface.

The artesian springs were discovered after excavation for a 30" storm drain. After placing a coarse sand bed, the pipe was installed and the excavation was backfilled with a coarse sand filter draining to daylight in a ditch. Hydrostatic forces developed by the artesian springs were thus dissipated without damage to the culvert.

An added drainage feature was the provision of perforated pipe in cut areas to relieve hydrostatic forces and prevent infiltration of water into the sub base. Since the sub base was clay, addition of moisture above optimum moisture content would cause reduced structural strength. Protected by the perforated pipe, cut areas will retain

design strength and differential settlement will be prevented.

Construction of the CVCC road provided excellent exercise for the earthmoving platoons, including the entire earthmoving train—dozers, tractor scrapers, water distributors, compactors and graders. In addition, carpenters, masons, and all members of the vertical platoons participated in drainage construction. Surveyors, soils specialists, and construction inspectors from Headquarters Company were involved. The training benefit to the battalion was incalculable. The project was built according to State specifications and was inspected by Russell County highway department personnel. Engineers of the 43d Engineer Battalion (Const) participated in a valuable training exercise enhancing MOS skills; Phenix City obtained an access road, and the Army received favorable media coverage in both newspapers and local TV.

An intangible benefit is the overall favorable publicity of the project and its impact upon the units recruiting program. community involvement by engineer units benefits both the units and civilian communities, and provides a viable alternative to reduced budgets for training materials and fuels.

Lieutenant Colonel Howard J. Guba is currently Chief, Plans and Topographic Branch, Field Engineering Division, Office, Chief of Engineers. He holds a MCE degree from Texas A&M University and an MS (Engineer Management) from the University of Alaska. He is a graduate of the Engineer Officers Advanced Course and the Command and General Staff College. His previous assignments include, Instructor, US Naval Explosive Ordnance Disposal School, Indian Head, Maryland; Assistant to Resident Engineer/Project Engineer, US Army Engineer District, Alaska; Staff Officer, Combat Developments command; Chief, Operations Branch, Lines of Communication Division, Construction Directorate, HQ MACV, Vietnam; and Commander, 43d Engr Bn (Const), Ft. Benning, Georgia.

INTERSERVICE TRAINING FOR EQUIPMENT OPERATORS

CPT Robert A. Formo

On 6 January 1975, a new Interservice Training Program was begun at Fort Leonard Wood, Missouri, for Construction Equipment Operators of the Army, Marine Corps and Air Force.

In developing this training program, particularly for the Army, a major change was made in the concept and organization of training. Course length, form and to some extent skills taught in each MOS were amended. In most cases, the courses have been shortened and provision has been made for more concentrated hands-on training. Two important considerations pervaded the new training program:

- provide the field an equipment operator who can operate more than one piece of equipment; and
- provide only that training which will be beneficial during the first enlistment term.

The above considerations serve to reduce the overall length of training, particularly when

coupled with the current shift in emphasis toward performance training and criterion tests. For example, the old seven week Crane Operator's Course (62F20), has been replaced by three modules in the Interservice Training Course. The modules consist of:

- a one week common core of fundamental subjects and vehicle operations in which a trainee learns to operate a 5-ton truck;
- a two week module in which the trainee learns to operate the crawler as a prime mover; and
- a two week module in which the trainee learns to operate a crane.

Although the overall training period was shortened, it is significant to note that there is no reduced standard — the trainee must still pass the required performance tests to graduate. Some believe that substitution of a shorter, multi-skill oriented course will produce a lesser skilled soldier than the old seven week single skill course. But, considering the amount of hands-on training for army equipment operators is at least double that which was provided during the seven week courses, the revised courses are at least as effective in providing basic operator skills as were the old courses.

This new training program provides the field an apprentice, capable of operating several varieties of equipment with job direction provided by a non-commissioned officer or another job supervisor.

In conclusion, the Interservice Training Program for Construction Equipment Operators seeks to provide a soldier with those basic skills and competencies which can be readily built on with experience and practical work within the context of his unit.



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Measure of Effectiveness



Mark G. Pell

In the past, it was an accepted military maxim that the winning General was the one who "got there first with the most." Today, opposing commanders have available rapid means of communications and control, the capability for remote surveillance and rapid transmission of intelligence, and almost instantaneous response of the application of firepower and maneuver by weapons which can achieve an extremely high first hit/kill probability.

Today the question being asked more and more frequently is: "What are the key factors which influence success on the battlefield and *how much* do these factors contribute?"

As Army Engineers, we have enjoyed the confidence of our combat commanders in our ability to contribute to the success of combat units. Typical Engineer tasks in the Division area include erecting tactical bridges, assault breaching of fortified positions, executing demolitions, cratering, employment of Atomic Demolitions Munitions (ADM), improvement of defensive positions, clearing fields of fire and landing zones, and improvement of routes.

Now we are being asked "How much does each combat and combat support task contribute to the

success of the battle?" This "show me" attitude should be expected when Army strength is being reduced, and civil programs of the government are competing with defense programs for a greater share of the national budget.

In order to develop an approach which will answer these questions, it is necessary first to establish "Measures of Effectiveness" by which results are evaluated quantitatively and allows the decision maker to make his selection relatively easily. For example, if a person were buying a car today and his primary criterion were fuel economy, a suitable "Measure of Effectiveness" (MOE) would be "Miles Per Gallon of Gasoline." This measure would make the selection of a new car simple. In combat, one of the accepted MOE is "Number of RED casualties." Another is the "Number of BLUE casualties." Taken together these two MOE result in a RED/BLUE casualty ratio, which is generally accepted as a measure of the results of combat.

If we, as decision makers, were buying a new weapon system and our criterion of choice were the destruction of the enemy, "numbers of casualties" produced by the weapon system would be a suitable MOE for judging the effectiveness of the weapon. It could also be readily relatable to the



MOE used for judging the results of the combat unit, since the two MOEs are identical. In this case, the decision makers would probably select those weapon systems which produced the greatest number of casualties.

If we, as decision makers, were buying a new piece of Engineer equipment used by Combat Engineers, for example, a new type of tactical bridge, the number of casualties is *not* the most suitable MOE for judging the effectiveness of the new bridge. Instead, our criteria of choice might consist of several considerations. First, the bridge must be capable of being completely constructed. This is a Go/NoGo type criteria. Obviously, if a bridge has a capability of spanning a gap up to 50 feet and the bridging requirement is 65 feet, this is a "No Go." In this case, the mission cannot be accomplished with that type of bridge. The second criterion might be erection time for the bridge, possibly expressed in "number of feet per minute" which can be erected. Using such methods, one type of bridge can be compared with other types of bridges. This MOE will serve the purpose of quantifying the effectiveness of the new bridge when compared with other types of Engineer equipment already in the inventory. However, we have not yet established the effect of this in-

creased capability for bridging on the outcome of the battle, which as indicated earlier, is measured by numbers of casualties.

Given the above, we can now state the problem as follows: "How can we relate improved Engineer performance measured by "time to complete a task" to the outcome of the "First Battle" measured by "RED/BLUE casualty ratio?" Quantifying this type of indirect relationship between combat support functions and the outcome of battles has been the subject of numerous study efforts and attempts to simulate these relationships. For example, for large units, i.e., Theater Forces, some success has been achieved, but the factors employed make it difficult to focus on specific support systems or equipment. For example, The Engineer Studies Group has used the Conceptual Army in the Field (CONAF) Evaluation Model (CEM) to reflect changes in the Engineer forces provided to a commander. Reduction of Engineer forces in this model increases the time required to accomplish combat engineer functions, which in turn, affects the movement rates of the force, which in turn, affects the location of the Forward Edge of the Battle Area (FEBA). This study effort is extremely useful for Army planners in developing balanced forces to support contingency plans. It would be helpful in answering the question recently posed by the Commander of the US Army Logistics Center at Fort Lee, Virginia as to the quantitative measure of the value of logistics support to a force or a combat unit. However, it is inadequate in helping the decision maker decide which piece of equipment to buy in order to produce the maximum increase in combat effectiveness.

Several other organizations have completed, or are in the process of performing, related studies which may assist in solving the problem stated above.

The Mobility Equipment Research and Development Center (MERDC) developed a model to attempt to relate the creation of delay due to obstacles to the outcome of a battle. The MERDC effort is entitled the "MERDC Barrier Effectiveness Model." This model does not completely solve the problem stated earlier.

Another related effort, produced for MERDC, demonstrated a method for evaluating the "Military Worth of Countersurveillance Systems." This effort draws heavily on the methodology used in the "MERDC Barrier Effectiveness Model."

The Commander, US Army Training and Doctrine Command, recently tasked the US Army Engineer School (USAES) (and other service schools) to make an analysis which would result in producing quantitative measures of how increased effectiveness will yield returns on the battlefield.



The Engineer School is currently analyzing this important problem. Since increased effectiveness in training is presumed to produce improved Engineer performance measured by time to complete a task, a way must be found to relate this to the outcome of the "First Battle" measured by RED/BLUE casualty ratio.

The Engineer School is attempting to develop a methodology which would produce evidence of this indirect relationship between Engineer task MOE and battlefield MOE and to quantify the results. The USAES is constantly learning from each of the efforts described above.

The steps in the Engineer School's methodology are envisioned as follows:

- For a specific Engineer task, establish parameters representing high, normal, and low performance times to accomplish the task.
- Conduct sensitivity analysis:
 - Playing each performance time in a suitable battle scenario using the high, normal, and low performance times as variables.
 - Measure results by using casualty MOE for the combat unit being supported.
 - Plot curves representing the MOE casualties when the high, normal and low performance variables were played.

* If the curve is flat, the analysis indicates that changes in the effectiveness with which Engineers perform their combat support task have no identifiable effect on the outcome of the battle.

* If the curve is steep, the analysis indicates that changes in the effectiveness with which Engineers perform their combat support have influenced the outcome of the battle measured by increased casualties. The changes in the casualty MOE serves to quantify how much battlefield effectiveness is improved by changes in the effectiveness of the Engineer support.

- Repeat this procedure for other Engineer tasks.

- Identify for further study or analysis each Engineer task which produces a steep curve since improvement in the performance of these tasks may produce a high payoff in terms of combat effectiveness.

In order to employ this methodology, a model is needed which will be capable of:

- Playing ground combat of a maneuver unit of battalion or brigade size and measuring results by number of casualties.
- Playing the performance of Engineer combat support tasks such as those described as typical in a Division area and being capable of varying the performance times for the tasks.
- Relating the performance times of the variables in the model to ultimate results of the battle as measured by the output in terms of casualties.

The USAES knows of no model which can currently perform in this manner without modification.

The US Army Engineer School project described above has been programmed for the next 18 months. It is now investigating possible models to be used for the analysis. Initial plans envision the use of the Mobile Assault Bridge as one of the Engineer tasks to be analyzed. This is also being used as one of the Engineer School pieces of equipment to be analyzed in the Training Effectiveness Project directed by HQ, TRADOC. In this way, the two related efforts can go on concurrently, which will allow the data and results to be used mutually.

If this approach proves successful, it will have wide application in quantifying many aspects of Army operations which indirectly effect the outcome of the "The First Battle."

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NEW TOOLS FOR OLD TASKS

Major William H. Sprinsky

Surveying, the act of making measurements for determining the positions of points on, above, or beneath the earth's surface, is a venerable trade whose practitioners span all geographic, ethnic and professional boundaries. The U.S. Army has been in the business of surveying almost from its birth. Today, all the services have need of survey information to accomplish their respective missions. This survey information spans the entire spectrum from road plan and profile construction survey to the computation of distances and azimuths between points separated by half the distance around the earth in support of strategic weapons systems.

The Defense Mapping School (DMS), located at Fort Belvoir, Va., has the mission of training the Military Service personnel who perform these missions for all of DoD. Techniques and equipment taught are those standard to service practice, but differ very little from standard civilian land surveying. The faculty of the school is a mix of military and civilian instructors who, by the nature of their experience, are very well acquainted with developments in surveying instruments in the civilian sector. In an attempt to modernize military survey equipment, these instructors are actively engaged in a program of equipment testing and evaluation, in cooperation with the U.S. Army Mobility Equipment Research and Development Center (MERDC) and the United States Army Engineer School (USAES) via the concept evaluation program of TRADOC.

Survey equipment, which has been marketed and proven in private surveying practice, is examined for service standardization. The equipment is adopted not because it is new, but it must help the military surveyor do his job faster, more accurately (in keeping with the ultimate use of his measurements) and must be rugged enough to function in a hostile military environment. The new equipment must also take advantage of the educational strengths of our present day soldier.

In the main, surveying equipment measures

one of the following quantities:

- directions or angles (these terms are not synonymous)
- distance between two points
- azimuths

A distinction will be made here between plane and geodetic surveying equipment. The assumption in plane surveying is that the level of the undisturbed oceans (mean sea level), carried under the land mass we occupy, can be approximated by a plane. All positions would then be located above, on or below this plane. This is correct only for small areas and so plane surveying techniques are used most commonly in construction of roads, airfields and buildings, registration of small parcels of land, and city (cadastral) surveys. Geodetic Surveying recognizes that, over large areas, the level of the undisturbed oceans, extended under the land masses of the earth, is curved (that is, the earth itself is rounded). Geodetic Surveys are usually much more precise (and costly) than plane surveys and are used to establish national networks of control and for support of strategic weapons systems.

In the field of plane surveys, due to tremendous improvements in electronics and optics over the last ten years, many new and improved distance measuring machines have been marketed. Those which MERDC evaluated were short range devices using the wavelength of a frequency of infra-red light to determine distance. The DMS tested the instruments by having instructors and students perform many measurements with each model considered, to assure that manufacturer's claims were accurate, that soldiers in the field could use them for military surveys and, in normal military use, that they were reliable. Although they are to replace the standard 50 ft and 100 ft tapes, which cost a fraction of the infra-red devices, the speed with which measurements can be made on lines up to 1.6 Km will significantly improve the capability of survey sections which

are part of units engaged in horizontal and vertical construction. The accuracy of the distance obtained are probably up to a magnitude better than those resulting from taping procedures, particularly on longer lines.

Another device evaluated by DMS is the "self-leveling" level which could replace the dumpy and military levels, if adopted. These self levelers use a suspended prism to establish the horizon. Rather than the complicated 4 foot screw leveling procedure common to the older instruments, a single "bulls-eye" bubble only needs to be aligned, the prism and suspension system take care of the rest. If you have ever done any spirit leveling or

watched even an experienced spirit leveling crew, you can appreciate the time savings this represents.

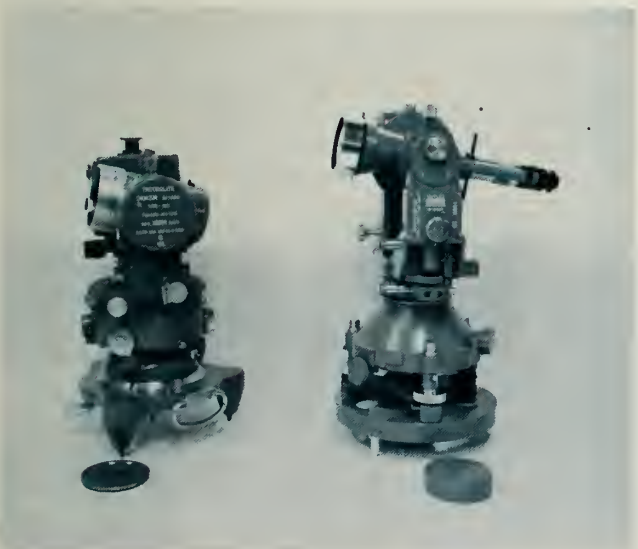
For the geodetic surveyor, a basic change in his precise theodolite, the Wild T-3, accurate to a fraction of a second of arc. It has been standard in precise horizontal positioning projects for over twenty years, but will be replaced by the Kern DKM 3. This new instrument is capable of the same accuracy but is more compact in its transportation configuration. Geodetic surveyors will also be able to use the new infra-red distance measurers previously described and DMS will be evaluating laser distance measurers for long range, precise



SELF LEVELING LEVELS, WHICH WILL BE USED IN CONSTRUCTION AND PRECISE LEVELING. RIGHT IS THE WILD NAC 3 AND LEFT IS THE ZEISS NI-2.



THE ZEISS NI-2 WITH ASTROLABE ATTACHMENT. THIS WILL BE EVALUATED AS A PRECISE ASTRONOMIC POSITION DETERMINING DEVICE BY DMS.



THE NEW SERVICE STANDARD PRECISE THEODOLITE, THE DKM 3 (LEFT) AND THE T3 (RIGHT). NOTE THAT THE T3 IS A STANDARD REFRACTING TELESCOPE WHILE THE DKM 3 IS A COMBINATION REFLECTING-REFRACTING TELESCOPE DEVICE.



THE CUBIC DM20, A MICROWAVE DISTANCE MEASURING DEVICE (LEFT). A BATTERY DRIVEN PSYCHROMETER (WET & DRY AIR TEMPERATURE MEASURER) AND POCKET BAROMETER (RIGHT) ARE PART OF THE COMPLETE SYSTEM.

point to point distances. Concurrently, and still on the subject of distance measuring devices, DMS will be testing and evaluating Microwave devices as replacements for the MRA 301, MC 8 and AP 99 now standard in survey units.

As mentioned previously, new is not necessarily better. One of the oldest astronomic positioning devices is the 60° Astrolabe. In its crudest form, this device predates the sextant. More refined astrolabe devices are used in most observatories engaged in the study of polar motion and time. A new astrolabe attachment for the same self-leveling levels mentioned previously will be evaluated at DMS. Many authorities in the field of positional or geodetic astronomy feel that this astrolabe-self-leveling level combination has the potential of being as accurate as instruments presently used by the services which are far more costly and cumbersome.

Any surveyor involved with astronomic positional measurements is intimately associated with the accurate measurement of time. Originally this was done with special pendulum clocks. More recently, we have used accurate electro-mechanical chronometers which are then calibrated with the National Bureau of Standards time standard, WWV or WWVH, which are radio stations broadcasting time signals. We now have as service standard a time set incorporating the latest in "quartz clock" oscillators and WWV/WWVH receivers which automatically record the exact time of an event observed with our special, high precision astronomic theodolites.

All the new equipment discussed would represent a real headache if data reduction from observations, now made quicker and easier, were to be done in the traditional way, that is by hand with logarithms. Our new soldiers have already been exposed, in public schools, to small, portable electronic hand calculators. A new development in the entire survey field is the adoption of scientific hand calculators into service standard survey sets.

These devices are being used and taught in DMS courses and the rapidity with which field data is being reduced may surprise and please all users of survey information, from the strategic missile man to the construction foreman on a road job. DMS is now redesigning courses of instruction, procedures, and methods of computation to take advantage of this strength in the modern soldier and improvement in the electronic calculator.

The future for the surveyor may be even more promising than what has already been experienced. Commercial applications of the Navy Navigation Satellite System hold great promise for fast, accurate point positioning. The testing and standardization of inertial positioning systems, mounted on all wheel drive vehicles, continues to be an area in which all the services are interested.

DMS technical experts in this field are part of the evaluation so that when a finished product is finally adopted, it will match serviceman strengths and capabilities. DMS technical experts may also be investigating commercially available digital readout transits and theodolites, which would remove much of the possibility of observer error or blunders in readings.

The final result of this effort by DMS and MERDC will be a survey capability for the services which is as modern and efficient as its commercial counterpart. The final result for the military surveyor will be that he is taught on modern, precise equipment and has a trade which he can pursue either in the service or in civilian practice.

Major William H. Sprinsky has received his MS and PhD in Geodesy from Ohio State University. He served as a Combat engineer and Engineer Maintenance officer in Germany from 1960-1964. MAJ Sprinsky served as an Engineer Equipment and Engineer Maintenance Officer in Vietnam



INFRA-RED DISTANCE MEASURING DEVICES IN A MERDC CONTROLLED ENVIRONMENT CHAMBER. FROM LEFT TO RIGHT, THE CUBIC DM 60, HEWLETT-PACKARD 3800, HEWLETT-PACKARD 3805, WILD D110 MOUNTED ON A THEODOLITE AND K&E MICRO-RANGER MOUNTED ON A LEVEL.

ARMY TRAINING GOES MODERN

Stanley Georges

For those constructively involved in education, current developments in the field of military training are proving to be revolutionary. In recent years, no educational concept has raised more discussion in the Army than the Training Extension courses (TEC).

Basically, TEC was developed by the Army, as a response to help soldiers in 3 vital areas. These are: On-the-job training, MOS tests, and integrated and concurrent training.

The TEC program centers on prepackaged lessons that are multi-media, soldier tested, and with both pre- and post-test features that can be used by individuals and units. TEC's features permit self-pacing and enable the user to perform goals directly related to an MOS and to perform on-the-job skills.

TEC incorporates two innovations that are of special interest:

- *Audiovisual lessons:* These are packaged with an audio cassette and a closed-loop color filmstrip that is synchronized through a "Cue-See," TV-like machine. The student learns from the color film and a "down-to-earth" narration.
- *Audio cassette player:* The cassettes, which provide audio only, are used as an extension to the audiovisual lessons to guide the student in "hands-on" practice for the equipment oriented skills that he learns from the "Cue-See."

Results from actual soldier-test situations indicate that the audiovisual lessons are stimulating, provocative and most effective as a teaching mode. In this context, it is significant to note that the Combat Arms have successfully adopted this training program over the last year. At present, the US Army Engineer School is preparing 14 generator operator TEC lessons that are scheduled to be in the field by December 1975 and is developing 15 diesel engine troubleshooting lessons that will be completed during the next calendar year. Furthermore, reports from the field indicate that by the beginning of next year most

military service schools will be involved in preparing TEC lessons.

Although TEC is not considered the "cathedral" of training modes, it has implications far beyond mere pedagogy. For instance:

- TEC training materials are designed to emphasize performance rather than mere theory, which was emphasized in previous methods of instruction. In other words, the emphasis is on what the soldier will do as a result of the training. Empirical methods are employed and validate the instruction.
- Unit commanders and trainers can easily use TEC diagnostic testing and evaluating to determine strengths and weaknesses in the job proficiency of individual soldiers.
- Training within units is enhanced because TEC provides trainers with high quality instruction in a ready-to-use form that reduces the need for unit trainers to develop lesson plans, visit training aids center, audiovisual support centers, post photo labs, or other agencies to obtain materials to support training. As a result, trainers can act more as evaluators — to test the student as he finishes his training, or as designers for new TEC lessons.

Finally, the innovative features of the TEC program overcome the traditional shortcomings of most courses of instruction — a one-way flow of instruction from Army service schools to individual soldiers at the unit level. By using high quality multi-media methods, the program focuses on the benefits of applying training technology to Army training. In doing so, it emphasizes the necessity of soldier performance, not instructor performance.

Details for the distribution of TEC lessons to Engineer units have not yet been finalized. However, according to tentative schedules, Engineer Combat Support and Combat Service Support units will begin to receive both the software (lessons) and hardware (Cue-See sets) in fiscal year 1976. The software will consist of common Army and Engineer subjects. The hardware will consist of eight sets of audiovisual equipment (Cue-See) and four sets of audio (cassette player) equipment per battalion.

Mr. Stanley Georges is assigned to the Doctrine and Training Literature Division, Deputy Commandant for Combat and Training Developments, U.S. Army Engineer School, Ft. Belvoir, Va. Mr. Georges has been with the above division since 1966 and is currently a TEC Project Manager. He is a retired Army Engineer Officer and has taught at the Engineer School both as an officer and as a civilian. He holds a Masters degree from the University of Maryland.



1000

GOOD



B

CPT Stephen P. Meyer

The United States Army Engineer School (USAES) has been in the forefront of TRADOC's development of dynamic initiatives in the field of training literature.

In November 1974, TRADOC announced the "1000 Good Books" program. This reorganization and vitalization of training literature has the objective of disseminating the Army's vital information to troops, while taking "nice-to-know" or specialized matters out of Army-wide use and placing such information in special texts for their selected audiences. Basically, the program is aimed at reducing the quantity of manuals while improving their quality, i.e., TRADOC will reduce the present 1700 manuals to the goal of 1000. The USAES's contribution to this reduction will be from 188 to 123 titles.

A key element of the program is the "How to Fight" manuals. Lessons learned from recent conflicts about the effectiveness of modern armaments and the increased difficulty of survival on the modern battlefield indicate that the tactics described in current manuals are no longer adequate or applicable. The "How to Fight" manuals will use the analyses of these "learned lessons" and capabilities of present day weapons to outline what must be done to win the first battle of the next war. The USAES's contribution to these manuals will cover the employment of the di-

visional and nondivisional engineer battalions. These are discussed in:

- FM 5-135 Engineer Battalion, Armored, Infantry and Infantry (Mechanized) Divisions.
- FM 5-136 Engineer Battalion, Airborne and Airmobile Divisions.
- FM 5-142 Nondivisional Engineer Combat Units.

The revised manuals will describe the four engineer roles in support of offensive, defensive, and retrograde operations:

- Impede enemy mobility.
- Enhance friendly mobility.
- Provide protective and defensive shelter.
- Fight as Infantry.

The USAES has also assumed responsibility for literature on "Barrier and Denial Operations" (FM 31-10) and will produce a "How to Fight" manual on this topic.

An important element of the "1000 Good Books" program are the TRADOC Bulletins. These are brief volumes — about 30 pages — which provide timely technical information to the field and explain, 'why we fight the way we do'. The USAES is currently writing two bulletins for TRADOC — Camouflage and Barriers.

Technical manuals which presently contain narrow slices of the "information pie," such as TM 5-350 — Hydraulic Power Control Systems, or TM

5-545 — Geology, will disappear under the "1000 Good Books" program. Their contents will be diverted to several locations. The material will be available either in the unit (civilian) book set, or a school text, or a soldiers manual — (a new one stop guide for each particular MOS).

The USAES has already produced its version of the soldiers manual as a prototype Individual Training and Evaluation Program (ITEP). This serves as an information "road map" with respect to a soldier's needs for proficiency in his MOS. Individual tasks, conditions, and standards are prescribed in accordance with the Systems Engineering approach to training.

Following the same principle at the unit level, the Army Training and Evaluation Program (ARTEP) is being produced to replace the old Army Training Program and Army Training Test (ATP/ATT). The ARTEP lists those tasks the unit must be able to perform in order to successfully accomplish its mission. The ARTEP provides guidance to units on how they should:

- conduct their training,
- administer their annual tests, and
- evaluate (training REDCON) their level of readiness.

The above three areas are based on unit tasks, conditions and standards.

The Training Circular (TC) has also been revitalized and now serves as a means to get "perishable" information to the field in a hurry. The USAES recently produced TC 5-200 (Camouflage Pattern Painting) — this explains to Army units the techniques of applying the new and improved camouflage paint they are receiving.

All the publications cited above have been changed not only in purpose but also in format. Ample use of illustrations, lively layout, and imaginative typesetting make these books much more readable than their predecessors.

The oft-cited complaint that the field doesn't "believe anything unless it's in a tan-covered, standard printed FM or TM" is a truism. But, the complaint continues, "even if the information is there, it won't be read because it's too dry and dull." With the publication of the new books, such complaints will be laid to rest.

Captain Stephen P. Meyer, is currently Project Officer, Engineer School, Deputy Commandant for Combat and Training Developments. He holds a BS degree from Drexel University and a MS degree from Clemson University, both in chemical engineering. He is also a graduate of the Engineer Officer Advanced Course. He has served as company commander in both Germany and Vietnam, and was an ROTC instructor at Clemson University.



BRIDGING

RETENTION OF SELECTED CSM PAST 30 YEARS

For the third consecutive year, Department of the Army intends to retain selected Command Sergeants Major beyond 30 years active service.

Eligibility for consideration will be limited to CSMs who have completed 30 or more years' active service and have an ETS during FY 76. Applicants must have a 1974 PMOS Evaluation Score of 110 or higher and be able to complete 35 years service prior to reaching age 55.

TIME-IN-GRADE CHANGE FOR RETIREMENT

The requirement for Army members in grades E-7, E-8, E-9, CW3, CW4, O-5 and O-6 to serve a minimum of two years in grade before being eligible for nondisability retirement has been suspended until 30 June 76, DA has announced.

Individuals in those grades who have completed all their service obligations and who are otherwise eligible may apply for voluntary retirement between now and 30 June 76 providing they have completed six months active duty in that grade — effective from the date of their promotion.

Officers of the reserve components and the Army of the United States without component who are serving, or have been offered retention beyond 20 years' service as an exception of policy, will not be involuntarily released from active duty earlier as a result of this suspension.

Interested individuals should refer to the procedures contained in Chapter 4, AR 635-100 and Chapter 12, AR 635-200 for submitting applications for retirement.

ADVANCED NCOES SELECTION BOARD RESULTS

The Advanced Noncommissioned Officer Education System Selection Board which convened 19 Feb. 75 and adjourned 12 Mar., has selected 4,936 of 15,713 eligible senior NCOs to attend Advanced NCOES during FY 76. MILPERCEN announced the names of the selected individuals in May 75.

Individuals considered had to have at least a high school diploma or equivalent. The board also reviewed the eligible NCOs' overall performance ability and potential for future service in making final selections.

NCOs selected from overseas assignments may return to CONUS to attend the school TDY and return, provided they would have at least six months remaining of their overseas tour upon completion of the school. Those NCOs must also extend their overseas tours for at least one year in order to participate.

NEW OER UPDATE

If approved without revision during current staffing, the new Officer Evaluation Report (DA Form 76) that becomes effective 1 January 1976 will be a significant departure from past reports. The proposed major changes include the following:

- **Rated Officer Input:** Rated officers would be required to describe in detail their most significant duties and responsibilities executed during rating periods. They would also have to list the performance objectives that most accounted for their time. The proposed requirement for rated officer input is purposefully designed to promote a continual discussion — one which would begin at the outset and be carried on throughout an entire rating period — between the officer and rater to determine the job description, set performance objectives, and mutually plan in advance toward mission accomplishment.

- **Separate Rater/Indorser Input:** Rating and indorsing officers would provide separate evaluation information on the new form. Specifically, the rater would assess performance (how well the rated officer actually accomplished the tasks of the job), while the indorser would evaluate the officer's potential (how well the officer can be expected to execute the tasks of a job demanding higher rank and added responsibility).

THE GAP

- **Expanded Role for Reviewer:** In addition to the reviewer's current responsibilities in the rating chain, he, like the indorser, would be required to evaluate the rated officer's potential.

- **Descriptive Emphasis:** The new form describes rather than quantifies; thus the rater, indorser and reviewer would not enter numerical scores in their evaluations of the officer's overall performance or potential.

- **Tailored to OPMS:** The form has been designed to meet the future requirements of the Officer Personnel Management System (OPMS). Since each OPMS specialty has unique management requirements, the report would be flexible enough to allow for — or in some cases, require — the inclusion of specific performance and potential data needed by specialty managers. The rated officer would also be able to use a portion of the form to enter a preference for specialty designation or a future assignment in a primary or alternate OPMS specialty.

- **Close Out Reports:** Prior to the 1 January 1976 implementation date of the new form, a closeout report on current DA Form 67-7 would be required for all officers. If approved, this action would not only preclude much of the apprehension normally experienced by those officers who would otherwise be due ratings during early 1976; it would also synchronize the initial rater/rated officer discussions of performance objectives which are being proposed in conjunction with use of the new form.

Certain aspects of the present evaluation system would remain unchanged once the DA Form 76 becomes effective. For example, rated officers would continue to receive personal copies of completed reports; a single form would still be used to evaluate all active duty and reserve component warrant and commissioned officers through the grade of Major General; and the professional attributes would continue to be evaluated. In this latter instance, however, rated officers could expect to find that the new form would feature expanded format entries addressing **professional competence, individual self-discipline, leadership, professional ethics, and professional orientation.**

Despite these proposed innovations, the forthcoming OER is not designed as a panacea for all past problems associated with the history of the officer evaluation process. Instead, the DA Form 76 now being staffed is an evolutionary form which, if approved, will be the first step toward continuing improvements in evaluating officers.

MOVEM SUPPORTS MOVEMENT

Moving soldiers across the country and around the world effectively is a vital link in the Army's chain. To help facilitate accurate controls and eliminate empty seats flying overseas at the Army's expense, MILPERCEN has developed the Movement Oversea Verification of Enlisted Members (MOVEM) report.

Under the MOVEM concept, 30 to 45 days prior to a given arrival month overseas, port calls are matched against assignment information on the Enlisted Master File. DA approved deletions and deferments are then scratched from the report and soldiers specified by DA to move during that arrival month, but who do not have port calls, are identified. From this a more realistic picture of exactly who will make their port call and who won't becomes clear. The MOVEM report, indicating soldiers unlikely to meet their port calls, is then prepared and forwarded to major commanders requiring either movement or an explanation of any unauthorized deviations. In this way, new arrangements can be made to transport those soldiers to their new assignments, if necessary, or arrangements can be made for other soldiers, on stand-by status, to fill their seats.

Since its implementation early this year, MOVEM reports have been sent monthly to the affected commands. Comments on the report and suggested improvements were solicited and have been active and useful. As the MOVEM program progresses, it will continue to provide effective verification of port calls for soldiers moving overseas and save the Army money by filling the seat of a "no show" with a soldier who needs the seat but normally wouldn't have the priority to have it.

Hey! Pal, Here is your personal copy of **The Engineer** magazine. I knew you were expecting it, so I brought it as fast as I could. I really don't know how Engineer Corps personnel cope with life without it? At \$4.00 a year, mailing costs included, there is no excuse for anyone to be without their personal copy.

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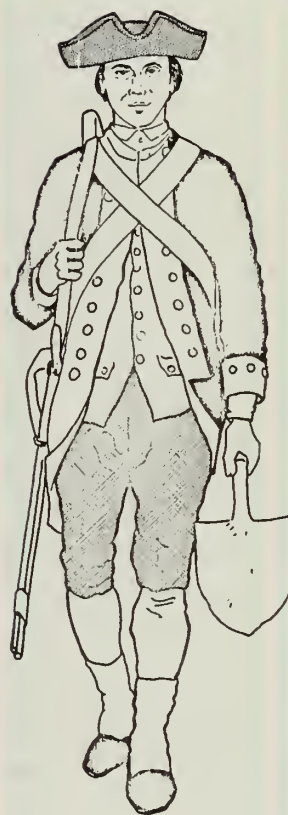


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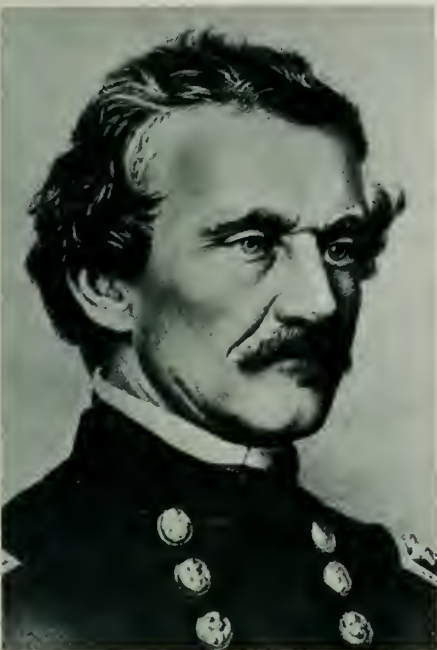
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CHIEF'S BRIEFS

Brevet Major General Andrew A. Humphreys was born in Philadelphia, Pennsylvania, November 2, 1810. His grandfather and father were naval architects, and both became Chief of the Construction Bureau, U.S. Navy. His grandfather designed "Old Ironsides."

Humphreys entered the United States Military Academy before he was seventeen years old and was graduated July 1, 1831. After a short service in the artillery, during which he was engaged in actions against the Seminole Indians in the Florida War, he resigned from the Army, September 30, 1836, to become a civil engineer.

Upon the organization of the Corps of Topographical Engineers, he was appointed first lieutenant, July 7, 1838.

In 1850 Humphreys was directed to make topographic and hydrographic survey of the Delta of the Mississippi River. Assisted by Lieutenant Henry L. Abbot from 1857 to 1861, the Mississippi River Survey Report, translated into several languages, remains a classic in hydraulic literature.

General Humphreys was a distinguished Civil War Army Corps commander. He received brevet rank for gallant and meritorious services at the Battles of Fredericksburg, Virginia, Gettysburg, Pennsylvania and Sailor's Creek, Virginia.

On August 8, 1866, Humphreys was appointed Chief of Engineers and after thirteen years of service in that position he retired on June 30, 1879.

General Humphreys published Civil War histories, was co-founder of the National Academy of Sciences, and a member of many learned societies. He died at Washington, D.C., December 27, 1883.

Edward B. Russell
Curator, US Army Engineer Museum

United States Army Engineer School Fort Belvoir, Virginia

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The Engineer is an authorized quarterly publication of the U.S. Army Engineer School. It is published to provide factual and in-depth information of interest to all Engineer units. Articles, photographs and art work of general interest may be submitted for consideration to: Editor, The Engineer, USA Engineer School, Fort Belvoir, Virginia 22060. Views and opinions expressed herein are not necessarily those of the Department of the Army. Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, January 1, 1974.

Subscriptions to THE ENGINEER are available through the USAES Periodical Publications Fund, Fort Belvoir, Va. 22060. Annual Rates are \$4.00 for domestic and APO addresses and \$5.00 for overseas addresses.

Engineer Magazine Telephone: (703) 664-2838 —
Autovon: 354-2838

ABOUT OUR COVER

A lot of you haven't been paying our fine publication all the attention it deserves. In fact, many show us little more than a cursory, page-fanning once-over. We know. And it hurts. But we're swallowing all that. And to show there's no hard feelings, we've offered a little extra service this month — we've put all the really eye-catching pictures and artwork contained in the magazine smack dab on the front cover! So you're spared all that finger-licking, corner-curling effort and our slick-format rag is spared its dog-eared plight. Is everybody happy?

PIPELINE. PIPE

PERSONNEL ARMOR SYSTEM FOR GROUND TROOPS (PASGT)



The combat engineer troops clearing a minefield shown in the photos above are equipped with the new PASGT Helmet and body vest. The PASGT underwent a concept evaluation test in connection with Natick Development Center and Human Engineering Laboratory with engineer troops at Fort Belvoir, Virginia, during the summer of 1975. The helmet is of a molded kelvar material and comes sized for small, medium, and large as does the knitted kelvar vest. The weight equal to that of the M-1 steel helmet provides for a 25% increase in ballistic protection. Notable is the helmet's shock-trauma protection capabilities allowing for engineering job site utilization as a safety hard hat.

MERDC ANNOUNCES J-SIIDS HOTLINE

Is your J-SIIDS giving you the protection it should?

Information on the installation and operation or technical assistance for the Joint-Service Interior Intrusion Detection System can be obtained on a 24 hour basis by calling the

J-SIIDS Hotline, Autovon 354-2085 or commercial 703-664-2085. After hour calls will be recorded and promptly responded to the next day.

This Hotline for J-SIIDS users is operated by the system's developers at the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Va.

Initial application of J-SIIDS is to provide protection for arms rooms against actual or attempted intrusion and equipment tampering.

J-SIIDS consists of a family of intrusion, duress, and pilferage sensors; monitoring and display equipment; a secure data transmission system and an audible alarm. The system was type classified standard for use in arms rooms in 1973.

ENGINEER DINNER AND CASTLE BALL DATES SET:

This year's Annual Engineer Dinner should be a gala affair. The annual dinners date back to 1867 when the Essayons Club was founded the year after the Corps turned over to the Army the responsibility for . . . "conducting the Military Academy at West Point."

The dinner is a time for engineer officers, active and retired, to come together and to be brought up to date on the state of the Corps. Over the past few years it has been held in conjunction with the Castle Ball — the Castle Ball being held with the ladies the evening following the Engineer Dinner. Both will be held at the Fort Belvoir Officers Club,

the dinner on Friday, 23 April and the ball on Saturday, 24 April 1976.

Additional information can be obtained by writing to the 109th Annual Engineer Dinner Committee, USAES Brigade, Fort Belvoir, VA 22060 or calling Fort Belvoir 664-4300.

ITSCHNER AWARD PREPARATION FOR CALENDAR YEAR 1975

Now is the time to start planning and preparing for the Itschner Award nominations. The Emerson C. Itschner Award is awarded by the Society of American Military Engineers (SAME) to the engineer company which best symbolizes the character, mission and performance of the Corps of Engineers. The award, presented annually at the Engineer Dinner at Ft. Belvoir, is named in honor of LTG Emerson C. Itschner, a former Chief of Engineers and past president of the society.

One of the aims of the award is to promote leadership in junior officers and to foster "esprit" in company sized engineer units. For the purpose of the competition, company sized units include all engineer numbered and lettered or headquarters companies, separate or belonging to a battalion, brigade, group or larger organization, and activated under a TOE/TDA. In the past, the award was limited to active duty units. In 1974, the competition was expanded, providing separate awards for both National Guard and Reserve units.

LINE. PIPELINE.

The 1974 winners were as follows:

Active Army: Company D, 802d Engr Bn, 2d Engr Gp, 8th U.S. Army, Korea.

Army Reserve: Company B, 458th Engr Bn (CBT), 1st U.S. Army (Pennsylvania).

Army National Guard: Company D, 145th Engr Bn, Utah National Guard.

Although the designation of a single winner from a field of highly qualified finalists is a difficult chore at best, the Itschner Award Selection Committee would like to see more units compete for this award. The key to turning out a winner, in addition to having the qualifying credentials, is to adequately document the unit's activities over the course of a given calendar year.

The necessary information should be bound in a simple three ring folder or loose leaf notebook.

The annual presentation of this coveted award provides a means of revitalizing the competition and renewing the challenge. How does your unit stand against the others? You can find out in 1975.

ENGINEER OFFICERS AND WARRANT OFFICERS DIRECTORY AVAILABLE

The Directory of Corps of Engineers Officers and Warrant Officers (1976 Edition) is available for purchase at the USAES. Mail order requests should be sent to: USAES Periodical Publications Fund, Office of the Secretary, USAES Fort Belvoir, VA 22060. Cost is

\$1.00 per copy (covers handling and mailing costs). Make checks payable to: USAES Periodical Publications Fund.

APPRENTICESHIP PROGRAM REGISTERED WITH DEPARTMENT OF LABOR

On 18 August 1975, the Apprenticeship Standards for Military Equipment Operators and Mechanics were registered with the Bureau of Apprenticeship and Training, U. S. Department of Labor, in a signing ceremony at Fort Belvoir. Signatories included the US Army Engineer School Commandant, MG James A. Johnson, and the Associate Manpower Administrator, Bureau of Apprenticeship and Training, Mr. Hugh C. Murphy. In attendance were the Executive Director of the Associated General Contractors of America, Mr. James Sprouse, the Assistant Commandant, and representatives from Department of Labor, Department of Army, USAES Staff and participants in the program. Registration culminated five (5) years of development effort during the period 1970-1975 and provides for national recognition of engineer training and experience thru the journeyman level. These Apprenticeship Standards became the first Active Army program registered with the Department of Labor (DOL).

Implementing procedures and printing of the Standards will be published by DA in Jan 1976. **Look for Annex D to AR**

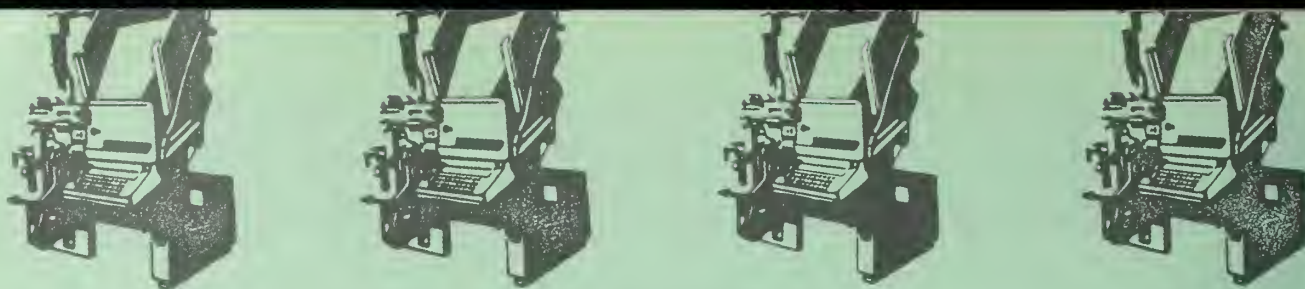
350-40. As an interim, the Engineer School (ATSE-TERM) will continue to accept applications under AR 350-14. For those personnel who are registered under this program, their records will be turned over to DOL when Annex D is published and full credit granted toward "completion of Apprenticeship" in line with the registered program.

FROM THE ENGINEER SCHOOL

At the request of the Armor School, the USAES has developed a simple device for armor personnel to evaluate bridge capacity. The device gives a "go/no-go" answer rather than a bridge classification. Four hundred copies of the "go/no-go" device have been forwarded to the Armor School for evaluation. At the end of the validation, a Basis of Issue Plan will be developed by the Army Training Services Agency (ATSA) and printing will be accomplished by DA in accordance with the Basis of Issue Plan for the armor card.

The working of the "Whiz-Wheel" is comparatively simple, the mere alignment of three wheels for (1) stringer spacing, (2) stringer code, and (3) the bridge span length, will give the "go" or "no-go" indication looked for. Instructions are imprinted on the card on how to obtain the dimensions needed.

Work is underway to expand the technique for engineers to produce a classification number and is expected to be fielded in early FY 77.



Since we first introduced ourselves in the Winter-Spring 1975 issue of this magazine, the Engineer School Learning Resources Center has acquired hundreds of new books in many subject areas. Due to space limitations we are listing here only a select few recent engineering books which may be of particular interest to our readers. These books, as well as others in such fields as military science, international relations, educational technology, management, and American history, may be borrowed through the interlibrary loan system at your closest library facility, or may be mailed directly to you. At the end of the loan period the material borrowed is returned in the original mailing envelope, using the return address label supplied by us.

We are most anxious to expand our field support program, and to that end we earnestly solicit your inquiries. We can be reached at AUTOVON 35-42524/41318, Monday through Thursday 0800-2100, Friday 0800-1700, and Sunday 1200-2100. Our mailing address is: US Army Engineer School, ATTN: Field Librarian, Learning Resources Center (Bldg. 270), Fort Belvoir, VA 22060.

Baker, Robert F. **HANDBOOK OF HIGHWAY ENGINEERING**. New York: Van Nostrand Reinhold Co., 1975.

Boyd, T. Gardner. **METALWORKING** (Goodheart-Willcox's Build-A-Course Series). South Holland, Ill.: Goodheart-Willcox Co., 1975.

Bresler, Boris. **REINFORCED CONCRETE ENGINEERING. VOLUME I, MATERIALS, STRUCTURAL ELEMENTS, SAFETY**. New York: John Wiley & Sons, Inc., 1974.

Brown, Walter C. **DRAFTING** (Goodheart-Willcox's Build-A-Course Series). South Holland, Ill.: Goodheart-Willcox Co., 1975.

Cedergren, Harry R. **DRAINAGE OF HIGHWAY AND AIRFIELD PAVEMENTS**. New York: John Wiley & Sons, Inc., 1974.

Dent, Joseph B. **FUNDAMENTALS OF ENGINEERING GRAPHICS**. New York: Macmillan Publishing Co., 1974.

Doyle, John M. **AN INTRODUCTION TO ELECTRICAL WIRING**. Reston, Va.: Reston Publishing Co., 1975.

Gerrish, Howard H. **ELECTRICITY** (Goodheart-Willcox's Build-A-Course Series). South Holland, Ill.: Goodheart-Willcox Co., 1975.

USAES ANNOUNCES TASK TRAINING PHAMPLETS

The Engineer School has developed a series of informal pamphlets to help junior leaders in training squad and platoon level ARTEP tasks. These pamphlets are designed for easy reading and provide step-by-step, easy-to-follow guidance on how to train specific tasks listed in the ARTEP. The emphasis is on training as a team.

Since the program is relatively new, there are only a few pamphlets available but more are on the drawing board. Those that are available are listed on page 101 of the USAES Instructional Material Catalog (USAES Pam 310-1) along with instructions on how to order the pamphlets. The following are currently available:

ARTEP TASK NUMBER	TITLE
4-13	Secure a Work Site
4-14	Recon Patrol
5-16	Route Recon
6-17	Disable a Bridge
6-18	Crater Roads
8-8	Layout a Bailey Bridge
9-2	River Recon

Soon to come:

7-5	Breach Minefield (Hasty Breach)
-----	------------------------------------

If you don't have a catalog, write to:

Director
Department of Army Wide Training
Support
US Army Engineer School
Fort Belvoir, VA 22060

and we will fill your order and send you a catalog at the same time.

Once you have had a chance to look the pamphlets over, we



"AS WE GO TO PRESS.

would appreciate your views. Your point of contact for errors, omissions, or new ideas is Unit Training Branch, Combat and Training Developments, at AUTOVON 354-3531. The mailing address is:

US Army Engineer School
ATSE-CTD-DT-TP
Fort Belvoir, Virginia 22060

SKILL LEVEL DESIGNATION CHANGES UNDER EPMS

On 1 Oct 75, MOS 62B, Engineer Equipment Mechanic, became the first MOS, for which the US Army Engineer School has proponency, to be implemented under the Enlisted Personnel Management System (EPMS). This means that all personnel with this MOS will have their skill level designation changed to reflect their skill level under EPMS.

PRESENT MOS	GRADE	EPMS MOS
62B40	E7	62B4
62B30	E6	62B3
62B20, 62B30	E5	62B2
62B20, 62B30	E1-E4	62B1

Tables of Organization and Equipment will be changed also to reflect the revised skill levels. There will no longer be a direct correlation between skill level and the category of maintenance as now exists (62B20 for organizational level and 62B30 for direct and general support level). Instead, the skill level will reflect the training and experience required to perform the tasks regardless of where (in what unit) it is performed. Modification of the training program

to support the revised MOS structure is underway and will be implemented this calendar year. In the meantime, the 62B20 course at Ft. Leonard Wood and the 62B30 course at Ft. Belvoir will continue. Individuals graduating from the courses will be awarded skill level designations to reflect their grade level. However, personnel records (DA Form 2-1) of those completing the 62B30 course will be annotated to show course completion.

MOBILE ASSAULT BRIDGE TRAINING

The US Army Engineer School is taking the following steps in an attempt to alleviate MAB problems identified in the field, namely; lack of trained crewmen and mechanics. Mobile Training Teams (MTT) are being formed to teach organization maintenance to USAREUR Units.

A "Mobile Assault Bridge Operator" draft text is in its final review and will be published in early 1976. This text will present to the individual soldier, as well as his supervisor, an analysis of the bridge-man's duties to include his job description (both present and EPMS revision) and a valid

task list. The bridgeman will be able to see his career development pattern, thus enabling him to map out his Army Career. Supervisors will be provided with various tips on training to include:

- Skills Development
- Training Evaluation Guide
- Safety Tips
- Basic Watermanship Principles

A maintenance manual, entitled "Maintenance Tips for MAB Platoon Leader," has been developed. This text addresses the maintenance items to be checked, as well as the sequence in which they should be checked.

Coordination has been made with MILPERCEN in an attempt to develop a more efficient method of coordinating and insuring that qualified MAB maintenance personnel graduating from the 612F1 Course (Mobile Assault Bridge/Ferry Maintenance Course) actually reach their intended unit of assignment.

To increase the readability of MAB texts, the Engineer School is introducing "Moe MAB" as shown here in his basic role of assault crossing. Moe will appear periodically throughout the MAB publications to pass on tips as well as introduce new sections.





Stop 16

Sir

In August 1975 I was a member of a group of US Korean War veterans who were invited to revisit South Korea. For many, this was their first return to Korea since the Korean War; in my case, it had been 13 years since my last visit.

Upon my return from Korea I thought perhaps the readers of *The Engineer* would be interested in some observations and comments pertaining to Korea as a result of the visit.

We saw the great progress made and being made in their economy and were impressed that the South Korean people were motivated to build their country strong — economically, educationally, and militarily. There was evidence of pride, dedication, high morale, competence and a constant effort of all to improve and grow.

During the six day visit, I visited with US Army, Corps, Division and Battalion commanders, a ROK Corps commander, and former Korean Military commanders of the Korean war era. As a result of my visit, I came to realize why the South Korean, 2d US Infantry Division and other US military forces in Korea have a high state of training, discipline, and combat readiness.

The basic reason is MOTIVATION, which is created by the proximity and aggressiveness of the North Korean government, and its armed forces, the closest of which are less than 25 air miles from Seoul, and within the range of enemy rocket artillery.

Thus a viable and universally understood threat to the South

Korean and US military forces, the capital, and the industrial complex of the Soeul — Incheon area provides the motivation, unity of purpose, and effort which characterizes the South Korean government and people. Upon returning home, I sense that Americans perceive no exterior military threat and consider only the threats from within.

It is reasonable to conclude that our own people's differences in threat perception as they relate to motivation affect the training readiness of our military forces stationed in places other than Korea. If the US is to maintain a high state of readiness, military leaders must provide a high standard of commandship/leadership to augment the threats facing them in order to provide the necessary MOTIVATION to produce superior units.

In a booklet, given to students at The Armor and The Engineer Schools, containing quotes attributed to me, there is this section:

ON MOTIVATION

- All your men want to do what you want done. When they do not, you have failed to instruct and motivate them.

- Awards that motivate only the top men are of little value in raising the ability of a unit. It takes awards to motivate the lower third to do that. A unit is measured by the ability of the lower third personnel in it to carry their part of the load.

- The first step in motivating soldiers is to tell them the reason why.

In another section is this

statement:

- Start off each period of instruction or training with two statements:

- Tell them what they are going to learn today.

- Tell them why they need to know it.

**General Bruce C. Clarke,
USA Retired**

Sir

Last year I wrote to *The Engineer* requesting a strong "what's happening now", approach in the magazine. Your Fall '75 issue is exactly what I was referring to. The *Engineer* Potpourri was exceptionally good. I am looking forward to the next issue.

**John P. Carey
Major, Corps of Engineers
Professor of Military Science**

Sir

On behalf of the cadets and cadre of the 1975 Fort Bragg ROTC Advanced Camp, I wish to express my appreciation for your thoughtfulness in providing us with copies of *The Engineer*.

The cadets enjoyed reading *The Engineer* and it certainly helped these future officers increase their knowledge of the Army.

Your thoughtfulness contributed significantly to the professional atmosphere of Advanced Camp 75.

Again, please accept my thanks; your attention to this matter is greatly appreciated.

**Ray Brackett
COL, AD
Public Affairs Officer**

Reorganization of the Engineers

MAJ James L Campbell

Introduction

The time between wars is the traditional time for the US Army to rethink the old theories and strategies: New force structures are postulated to meet new threats and new materiel developed to equip the new organizations. Coupled with this traditional rethinking of the past, the Army is now challenged by the all-volunteer Army concept. This concept has resulted in smaller, better equipped forces that will offset much of the personnel reductions by improving the quality of the American Forces.

The Corps of Engineers should take this opportunity to rethink our combat support methods. The basic reason for the engineers existence is to enhance the combat power of the combat arms. The engineers' mission is to enhance the combat power by facilitating ground movement of friendly forces. Enemy force movements can also be impeded by engineers. This gives the net effect of aiding the friendly combat power. Other engineer missions include providing engineer staff planning and advice on construction, facilities engineering, and any other engineer services required in the theater of operations. These missions will shape the direction of engineer force structuring in the rethinking process. All decisions must be geared towards providing a highly responsive, adequately equipped engineer force that can provide what is required by the tactical commander. The decisions made now should be tempered with the mistakes that history contains concerning post war organizations. As the Army has shrunk in size after past wars, the orientation is towards retaining combat elements and letting the combat support tail shrink. This is the correct way to curtail the Army's size. The apparent solution for the Corps of Engineers is to eliminate or curtail the construction forces. This solution prevailed after both the World Wars and the Korean War. While, at the time, this solution appears the most cost effective

and oriented towards achieving maximum combat power from the least possible expenditure, it is not necessarily the most economical solution in the long run. This article suggests another way that the same funds could be spent while providing enhanced engineer capability to carry out the combat zone tasks. This "ideal" solution is possible and should be considered in designing the engineer force of the future.

The after action reports and other articles written at the conclusion of each major campaign or war contain a plethora of data concerning the engineer force problems. Each of the reports contain many platitudes concerning the engineers' role in providing combat support. That speaks very highly of the engineer combat support in past wars. These same reports are laced with accounts of the Corps' one big failing . . . lack of combat construction support. Each of our wars has required a logistical tail. Yet the forces to build the depots, hospitals, airfields that are needed to supply our fighting forces have not been fully effective. The engineers should consider the reasons for their past inability to provide adequate construction equipment and expertise. No one is suggesting that combat engineer units be eliminated. This would be folly. Combat engineers are vital to the tactical commander. Another solution does exist that will satisfy both of the requirements of having highly motivated and responsive combat engineers and also having the skills and the equipment necessary to provide the construction needed to supply the tactical commander with the logistics needed to carry out his operational plans.

Before stating this cost effective way to increase the combat engineering capabilities while retaining construction expertise, it might be best to review some of the specific facts and deficiencies of the Corps as expressed in several reports published after several past campaigns and wars.

From the practical standpoint, the value of engineers is rated in terms of their value to the tactical commander. This point was not always practiced in the Army. For instance, until the reorganization of the Army in 1876, the division commander did not have clear cut authority over where the engineers constructed their fortifications. That reorganization brought the artillery, the ordnance and engineer commanders into association with the division commander to develop a unified course of action. This action clearly made the tactical commander responsible for developing the course of combat actions.

After World War I, engineer strength dropped as did the total Army. A low point was reached in 1937, when a 175 man engineer company was the only engineer unit organic to the division. Prior to Pearl Harbor, combat engineering was the preoccupation. A new tactical concept of lean units that traveled lightly and rapidly, further focused thoughts on combat engineering. But the funds to implement the combat engineering doctrine were not adequate. The necessary equipment to overcome natural and artificial obstacles was not present in the force structure. This lack of combat engineering equipment carried over into the start of the war. During the prewar years, the emphasis upon combat engineering placed a premium on light and maneuverable construction machinery. The small equipment items did not provide adequate construction capability to carry out the major construction tasks that were required. The emphasis on combat engineering at the expense of the construction capability caused future hardship in the mobilization construction process in the early part of the war. However, one major stride forward had been taken when it was recognized that machinery could do more than manpower. The percent of the total force that was engineer during World War II was less than in previous conflicts.

One important fallacy, believed by the Corps prior to World War II, was that if a conflict occurred, commercial products such as construction equipment could be had for the asking. This was a wrong assumption. When the industrial might of the United States was, at last, directed to war production, the steel and other metals that would have been used for construction machinery were needed in higher priority items such as tanks, ammunition, aircraft and ships. Thus, the construction machinery took its place in line after the higher priority times. The gap between requirements and actual delivery of machinery was abridged by procuring used items that were pressed into service.

One of the first engineering tasks, outside the US, was in the Southwest Pacific campaigns. The

Army was involved in an island hopping campaign to steadily advance the bomber line closer to the Japanese homeland. This strategy dictated significant airfield construction. The after action reports and histories written about these campaigns have many comments about engineer support. The engineer combat battalion was "grossly inadequate to meet the requirements imposed upon it by the tactical and technicological demands arising from modern warfare..." "The mechanization of forces had increased the dependence upon engineer construction of roads. The movement of all mobile equipment is dependent upon approach routes and bypasses around obstructions." It was recommended that the engineers be increased to regimental (two battalions) size to handle the tremendous amounts of work required.

The Southwest Pacific histories also noted that "Engineer heavy construction units were always insufficient prior to the occupation of Japan." "More often than not, engineer units, in insufficient numbers, were brought in late without the heavy construction equipment needed to meet the target dates of their high priority construction missions."

Airfield construction was not the only major task faced by the engineers in the Southwest Pacific. "The construction and maintenance of roads constituted the principal engineer problem on Leyte. Although the more important existing roads on the island were initially classed as two-way, all-weather roads, they were not properly constructed to carry continuously the heavy traffic of modern warfare. "The combat engineers devoted almost one hundred percent of their effort to road and bridge construction." "It was not unusual for an engineer combat battalion to be responsible for maintaining 30 to 40 miles of road forming the main supply routes for its division. These roads were often little more than passable."

Engineer support in the Southwest Pacific was apparently adequate because we achieved our objective of "winning the war." It is very hard to assess the impact that more adequately equipped engineers would have had in enabling better roads construction so more supplies could be made available to the combat units. Likewise, how much faster could the war have been concluded if accelerated airfield construction would have advanced the bomber lines faster?

The Italian Campaign histories had no derogatory comments regarding engineer support of the combat operations. The support provided for other activities, however, was commented upon. "Construction was delayed materially due to the lack of adequate equipment throughout the campaign. This lack of equipment was alleviated by the creation of light equipment companies to support combat battalions, by the creation of large

equipment pools located at major headquarters and by the issue of excess equipment to the engineer units." This lack of equipment also was complicated by the lack of adequately trained equipment operators and mechanics.

Currently, the major threat considered by the Army is assumed to be in Western Europe. Over thirty years ago, we fought another war over what was then the most highly developed geography and road nets in the world. The roads in Europe are still the densest of potential areas of conflict. Many of the historical comments concerning the problems of our engineers in those circumstances regarding road maintenance, equipment problems and organizational constraints are still apropos. While the road nets in Europe have drastically increased over the thirty year time interim, so have the logistical requirements needed to carry out the land and air mobile types of conflicts that are envisioned.

The Twelfth Army Group, which orchestrated a major tactical effort across Europe during the war, noted that the "only serious deficiency in the training of engineer units has been in the technique of road repair." "Operations in this theater have disclosed the inadequacy of numbers of heavy equipment operators allowed."

The final report of the European Theater Engineer echoed many of the same comments made by the Twelfth Army Group Engineer. "The most important deficiency noted was a failure to maintain the asphalt roads." "The shortage of equipment necessary for road repairs was felt severely." The personnel problems were noted again. "One of the two most serious engineer problems in ETO and one which had widespread and continuing effects on our operations was related to the lack of technically skilled specialists, both officer and enlisted men, to fill the needs for

such personnel in staff and troop positions."

The message of World War II engineer deficiencies shows that there was a lack of sufficient heavy engineer construction equipment to provide combat support for the mobile warfare concept. Secondly, the personnel were not adequately trained or exposed to construction, even minor combat construction, to perform adequately to avoid adverse comments.

The problems of engineer support for tactical units is constantly surfacing. Figure 1 provides some insight into engineer support of certain campaigns that were studied. It can be noted that the ratio of engineer battalion support for each division was around 3 per division. This figure does not include the divisional battalion. Historically, we could conclude that four engineer battalions were used in the combat zone to support each division. Additionally, a number of engineer construction units were also in the COMMZ to construct the massive road networks and logistical complexes needed to supply the combat units.

The Korean and Vietnam actions necessitated somewhat different engineer support. Figure 1 shows that the ratio of combat engineer support was somewhat lower than the 3 corps battalions per division that is traditionally expected. An important point to note is that 9 of the 15 nondivisional engineer units in Korea were construction units. This indicates the equipment in the combat engineer battalions was not sufficient to carry out the construction needed to support the combat zone units.

Vietnam was a unique experience for engineers. Significant engineer construction was in support of political and nation building goals. Sixteen of the 28 nondivisional engineer battalions in Vietnam were construction battalions. Additionally, all but three of the combat engineer

ENGINEER SUPPORT RATIOS

Actual Number of Units												Recommended Engineer Support					
Theater	Date	Army	Corps	Div	COMMZ Engineer Battalions												
					Nondiv Engr Bn			Gen Svc/Engr Aviation Bn				Nondiv Engr Bn/Army Area		Nondiv Engr Bn/Corps Area		Nondiv Engr Bn/Div in Combat Zone	COMMZ Const Bn
					Combat	Const	Gen Svc	Nondiv Engr Bn/Div	Combat	Const		Combat	Const	Combat	Const		
ETO	1 May 45	5	15	57	147	10	12	2.96	7	7	102	9	9	8	0	3.5	—
12th Army Group Europe	Apr 45	4	11	43	126	—	6	3.07	—	—	—	—	—	—	—	—	—
Leyte Campaign	Oct 44	1	2	4	10	1	1	3.00	—	3	15	16	—	9	—	3.58	—
Lingayen Campaign	Jan 45	1	2	4	6	2	—	2.00	—	1	2/9	—	—	—	—	—	—
Volturmo Campaign	11 May 44	1	3	7	9	—	10	2.71	—	—	—	—	—	—	—	—	—
PO Campaign	Apr 45	1	2	6	12	—	4	2.66	—	—	—	—	—	—	—	—	—
Korea	Apr 51	1	3	6	6	9	—	2.50	5	2	—	3	13	4	—	4.66	6
RVN	Jul 68	—	—	8	12	16	—	3.50	—	—	—	—	—	—	—	—	—
Example: ETO																	
					$\frac{147 + 10 + 12}{57} = 2.96$												

Figure 1

battalions were augmented with a light equipment company to make them comparable to a construction battalion. The issue of excess equipment to these units still was not adequate to supply the capability needed to do the required construction. Over 650 items of high production construction equipment such as dump trucks, large rock crushers and rollers were provided in addition to the TO&E authorizations to achieve the road building program goals.

Figure 1 not only provides some insight into the historical allocation of engineer troops but also presents some of the requests and guidelines proposed for engineer support by the theater engineers. It can be seen that although the job got done, the senior engineers recognized that more engineer support was required to complete the job the combat commander really needed to have done to insure that the combat plans were carried out as scheduled. In each case, the stated theater requirements for engineers always exceeded available engineers.

History has provided examples to illustrate that engineers were deficient in construction equipment needed to support combat operations. The equipment was scarce because the planners thought it could be easily obtained when a war started. The personnel that were supposed to operate the equipment were not adequately trained. This is obvious because the equipment was not in the Army, and there was little construction training between wars because the focus of the army was on the combat engineering tasks. Perhaps the most significant observation coming out of the war was that a doctrine of mobility in combat dictates a vast combat engineering construction effort to support it. When one considers the improved air mobility and tactical vehicles currently in the Army inventory,

it is hard to understand why more roads and other engineer construction must take place. It must be remembered that sooner or later, the tanks and helicopters need POL and ammunition. Trucks bring these items to the front. The logistical tail runs on roads. Not only has the need for highly mobile warfare created a need for more engineer construction, but the size of a divisions area has also increased without a comparable quantum jump in engineer support. In the 1944 time frame, a division area was approximately 100 square miles. Currently, the division area is 625 square miles. This is over a six-fold increase in size. This six-fold increase in area means a potential six-fold increase in road construction and maintenance, bridge construction, obstacle construction and removal, and the complete variety of engineer tasks. While the engineer equipment has become more productive, and selected items have been added to the engineer battalions, there has not been a six-fold increase in the productivity of an engineer battalion.

New Concept

In 1974, the Army took a major step towards bridging the mistakes that history has shown in the engineer organization. The Engineer Combat Battalion (Heavy) concept was introduced as a new engineer unit. The existing engineer construction battalions were converted to "heavy" battalions and given a whole new mission and training concept. These new battalions retain construction equipment and have additional small arms, communications equipment, and anti-armor support weapons. The mission of this unit emphasizes use in the combat zone in the same role as the combat engineer battalions. This was a major step forward which moved the much needed equipment

RELATIVE COMBAT CONSTRUCTION CAPABILITIES*

Task	Heavy Bn to Combat Bn	Heavy Bn (Minus One Co) to Combat Bn	Heavy Bn to One + 1/3 LE
Barriers	1.07	0.75	1.07
Roads	2.25	1.50	1.28
Heliports	2.00	1.36	1.50
Field Forts	1.20	1.18	1.07
Misc Tasks	1.10	1.50	1.07
All Tasks**	1.87	1.50	1.07

*The methodology and numbers presented in this figure are fully developed in "Construction in the Combat Engineering Role", ESG, Jan 74.

**This row implies, for example, that a heavy battalion minus a construction company is 50 percent better at combat construction tasks than a combat battalion.

Figure 2

forward in the combat zone. The tactical commander can now count on considerably more engineer support than was previously available from the Corps combat battalion. One of the engineers most important asset — specialized equipment — is now more responsive and available.

Now, however, the engineers are facing the challenges of providing engineer support at the minimum cost. There is a powerful temptation to begin eliminating the Engineer Combat Battalions (Heavy) from the force structure because they cost more to maintain in the absolute dollar sense. This temptation must be resisted, and the heavy battalion should remain — even at the expense of the standard combat battalion.

A recent study carefully evaluated the ability of the construction battalion to fulfill the missions of the engineer combat battalions. While this study used the construction battalion as the base, the Engineer Combat Battalion (Heavy) has the same major items of construction equipment, so the comparison is still valid. A detailed requirements matrix was compared with equipment capabilities. Figure 2 compares a heavy battalion with a combat battalion in doing all of the construction tasks that the combat battalions are currently tasked to do. The figure shows that the currently organized heavy battalion has an ability to supply the tactical commander with 87 percent more combat construction support than the combat battalion does. If no costs were involved, the heavy battalions should replace the combat battalions because they provide more support for the tactical commander. However, dollars do matter.

Figure 3 shows the cost of maintaining a combat and a heavy battalion in the force structure for one year. Initial procurement costs are also shown. The heavy battalion costs over 24

percent more to keep in the force structure than the combat battalion. Although an 87 percent increase in construction capability surely merits an increased cost of 24 percent, this rationale is not directly applicable in a constrained resource environment such as the Army is currently operating in.

Figure 3 also portrays the alternative of having one third of a light equipment company augment a combat battalion to give approximately the same combat construction capability as the heavy battalion. It can be seen that a 7 percent increase in capability would cost 13 percent more, which is clearly not economical. So the solution of a light equipment company augmentation to a combat battalion is not the most economical route to obtain increased combat construction support.

Another alternative is to use the reserve force roundout concept. One of the construction companies in the heavy battalion could be eliminated from the active force structure and the battalion could become the parent unit for a reserve company in event of a mobilization. The cost for this alternative is also listed in Figure 3. The savings to the active force structures would be a savings of nearly 4 percent over the current combat battalion in the force structure and an increased capability over the combat battalion of 50 percent. This 50 percent increased capability is based on the fact that the roundout company might not be rapidly available, so it was not included in the calculation. When the roundout company is fully operational, the 87 percent increased capability of a normal heavy battalion over a combat battalion would be effective.

It seems clear that one alternative to lower the cost of maintaining the active engineer force is to take advantage of the superior combat construction capabilities offered by the heavy battalions

COST COMPARISON*

	Costs	
	Recurring	Non Recurring
Heavy Bn	\$15,654,680	\$15,501,553
Heavy Bn Minus D Co (Bobtail Bn)	11,973,610	11,962,823
Combat Bn	9,772,707	12,467,468
Combat Bn + 1/3 Light Equipment Co	11,511,100	13,814,799
Cost Savings of "Bobtail" vs Combat Bn		504,645
Percent Annual Cost Saved "Bobtail" vs Combat Bn		4 Percent
Percent Annual Cost Saved "Bobtail" vs Combat Bn + 1/3 LE		13 Percent
Percent Increase in Capability "Bobtail" vs Combat		50 Percent
Percent Annual Cost Saved "Bobtail" vs Heavy Bn		23 Percent

*Cost data obtained from Force Cost Information System (FCIS), Comptroller of the Army, Dec 74.

Figure 3

over the combat battalion. The savings of 4 percent in absolute costs versus an increased capability of 50 percent seems to be an alternative that should be seriously considered in the days ahead. The roundout concept would be in consonance with other activities within the US Army and also structured along the lines of other armies in the world that rely to a large extent on reserves rounding out the total force. It should be recalled that the engineers have a high percentage of their total force in the reserve structure when compared to some other branches of the active Army.

If a detailed analysis of the roundout concept proves feasible, the Corps should make the total bridge to this concept and eliminate the current Corps combat battalion from the force structure. The divisional units should remain essentially as they are, but perhaps some selected items of equipment could be placed in these units. Succinctly stated, this concept seeks the designation of only one type of nondivisional engineer battalion, i.e., THE Engineer Battalion. Having one battalion in the force structure to provide nondivisional engineer support increases the engineers main resource — equipment — available to the tactical commander. THE Engineer Battalion would be the only nondivisional engineer battalion, so there could be no problem with accepting the fact that THE Engineer Battalion provided the support needed for combat operations. It would receive the same treatment by force planners as the current combat battalion does in tooth to tail calculations.

There are many advantages more significant than a clearer definition of engineer roles and missions, however. The historical examples cited document a recurrent lack of training and experience in the many facets of construction and engineering needed to construct the more massive logistical projects located in the COMMZ. By retaining the varied MOSs and specialized equipment in the force structure now, peacetime training in the use of the construction equipment would provide a base of trained people to build upon in the event of mobilization. The prospect of having readily available, specialized resources such as plumbers, carpenters, and electricians available in TO&E units during peacetime is an attractive proposition to money managers trying to stretch the facilities engineer dollars. The fallacy of readily obtaining needed construction equipment from the civilian industry would not apply. Granted that the equipment on hand would certainly not satisfy the total requirement for construction equipment for a large engagement, but there would certainly be more equipment on hand than were none to be maintained in the active force at all.

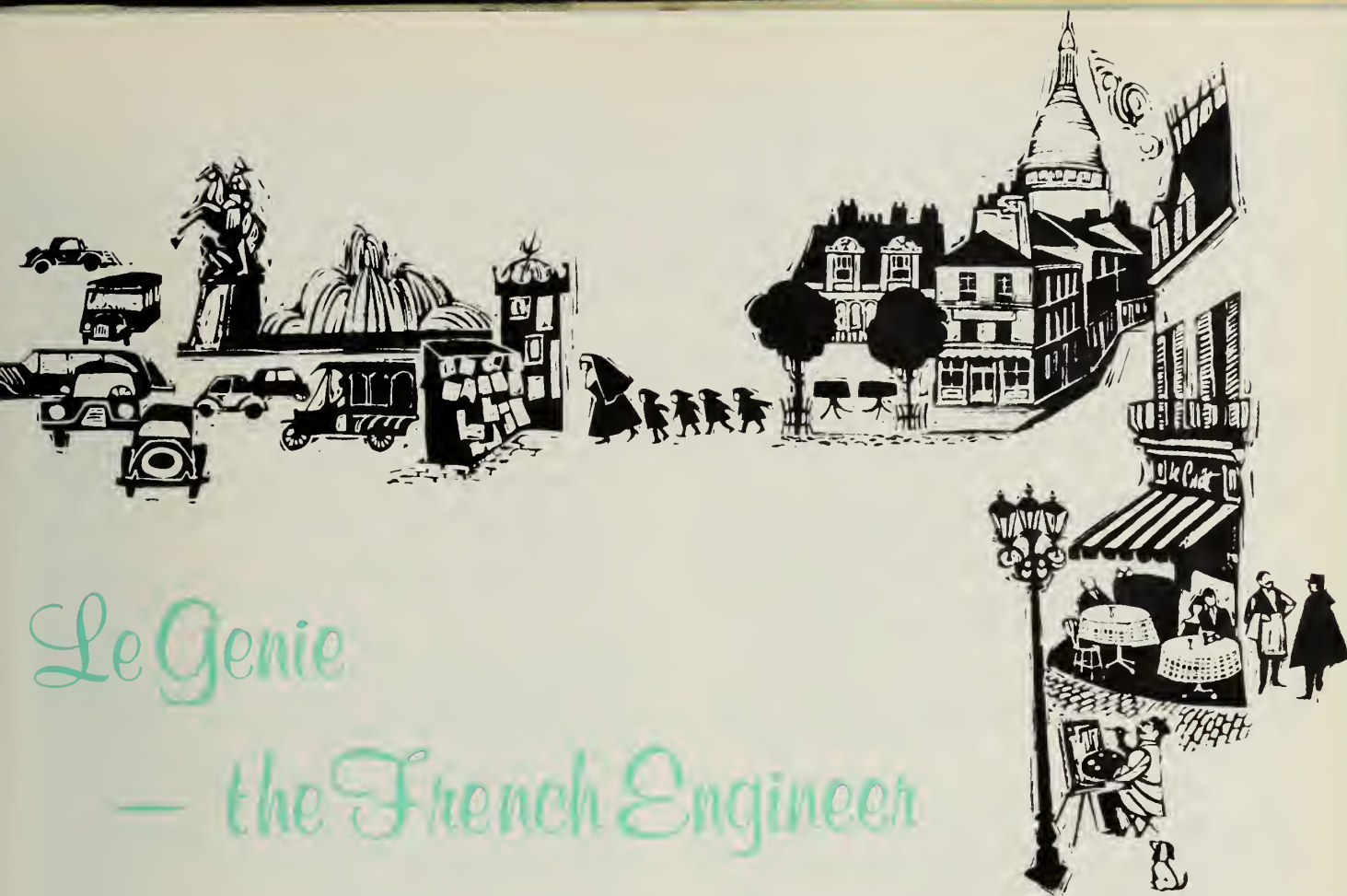
Plan Now for Future Missions

The time is now at hand to rethink the problems of engineer support to the tactical commander. One concept that appears to offer some increased capability, coupled with a decreased cost, is the idea of having just one engineer battalion. This battalion would be essentially the existing Engineer Combat Battalion (Heavy). The concepts of providing more equipment forward in the combat zone and of maintaining equipment and sparse critical skills in the force structure during peacetime, certainly merge with the lessons that have been demonstrated concerning past engineer support problems. The value of clearly placing the engineers in the role of combat support is considerable. This is not to imply that the vital tasks of logistical construction for the COMMZ will be forgotten. The same capability will exist in THE Engineer Battalions that currently exists in Engineer Combat Battalions (Heavy) which are tasked with providing construction for the COMMZ. The added benefits of the one battalion idea is that the battalion will be able to do tasks in the combat zone as well as their existing missions in the COMMZ.

History again provides us with examples of the engineers having to reorganize and re-equip after hostilities start in order to accomplish their mission. These examples should teach current force planners that the nucleus of the engineer force should be available in the active force structure. New organizations should not be developed in time of emergency but rather be planned for and developed now, based on the lessons of history. THE Engineer Battalion concept provides increased combat construction capability, decreased cost, and provides potentially available personnel for peacetime construction activities. THE Engineer Battalion concept should be "rethought" now. Reorganize now to make initial engineer equipment readily available in future combat zones. History points in that direction!

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MAJ Campbell has served as platoon leader and company commander in both construction and combat engineer battalions. MAJ Campbell received a B.S. degree from the South Dakota School of Mines and a Masters degree from Texas A&M University. He is also a graduate of the Engineer Officer Advanced Course, Command and Staff College and is a Registered Professional Engineer.



Le Genie

— the French Engineer

LTC Henri C. Aiglon

Like many French institutions, the history of the French Engineers dates back to the 18th century. More specifically, in 1776, the Engineers were reorganized to constitute an integral branch of the French Army. Prior to this reorganization the Engineers were not regarded as military officers but were considered as technical advisors for fortifications and during siege wars. These engineers were trained at the only engineering school in France at the time — the famous Royal Military School of Engineers at Mezieres.

Despite these humble origins, the French Engineers have provided many notable leaders. For example, Sebastien Vauban, who became a Marshal of France, and Major General du Portail, who was accorded the honor of being the first commandant of the US Corps of Engineers.

However, since the above reorganization, the French Engineers have undergone numerous changes with respect to organization, training and functions. Some of the major characteristics of the present Engineer Corps are as follows:

• ORGANIZATION AND RESPONSIBILITIES

At present, the strength of the French Corps of Engineers is about 38,700 men (including 2,500 officers), this is, about 10% of the Army, and it

is organized into two parts:

L'ARME (i.e., the units: either combat or multi-purpose) with a mission defined basically as "to organize and improve the ground with the object of facilitating the maneuver of friendly forces and to restrict that of the enemy." In general, the missions are similar to those of the US Corps of Engineers with the following differences:

- **It is not responsible for:**
Topography (Artillery) and Mapping (Service Geographie de l'Armee = Army Mapping Agency).
Pipeline construction (Defense Petrol, Oil and Lubrication Agency).
Smoke Mission (Artillery).
- **It is responsible for:**
Flame mission.

Le SERVICE (Military Construction) is responsible for building and maintaining all barracks and facilities, quarters, hospital and training areas necessary for the proper functioning of the Army, and at times for the Air Force and Navy. However, it must be noted that "le SERVICE" is not responsible for "civil works."

• COMMAND AND CONTROL:

At Department of Army level, command and control is divided between:

The "Inspecteur du Genie" (The Inspector). This general officer and his staff are responsible for elaborating and formulating the policy on Engineer affairs: doctrine, tactics, equipment, training, combat readiness, and so forth, including technical matters. He is also charged with the inspection of all Engineer units, organizations and installations. He is the head of the Corps and is normally a Lieutenant General.

The "Directeur Central du Genie" (The Director), usually a senior Major General, holds the number two position in the Corps. He and his staff are responsible to:

The Inspector for the implementation of his policies.

The DA for the management of Engineer personnel matters, promotions, and assignments.

Below DA level:

At the military region level (France is divided into 7 military regions, plus French forces in Germany), we have a "Commander and Director of Engineers" and a staff. This officer, normally a Brigadier General, and sometimes a Major General for the more important regions (for example, Military Region 6 in Eastern France) is the Engineer advisor to the Commander of the region, and is the Commander of all Engineers stationed in the region (Engineer units and districts).

• L'ARME: (the Units):

These consists of twenty-three regiments, plus the "Brigade des Sapeurs Pompiers de Paris" (Paris Firemen Brigade — 5,000 personnel), and one school located at Angers — equivalent to the US Army Engineer School at Fort Belvoir. The Army Engineer units are organized in terms of Force Systems. There are three different types:

Main Combat Force Territorial Defense Force Overseas Intervention Force

Engineer units are often stationed overseas, and there are also Engineer officers and NCOs serving as advisors overseas, mainly in Africa. The characteristics of the most important units assigned to the **Main Combat Force** are:

At Brigade level: 1 separate Combat Company (171 personnel).

At Division level: 1 Regiment (749 personnel) consisting of:

Headquarters and Headquarters Company
1 Equipment and Bridging Company
2 Combat Companies

Thus in a Division of 3 Brigades, the Engineers constitute 1262 personnel, and 5 Combat Companies. All Combat Squads are equipped with the French Combat Engineer Vehicle (CEV). (This is a type of Armored Personnel Carrier with a dozer blade, a foldable boom, a winch, a 20mm automatic gun, and is capable of carrying 10 personnel). The bridging equipment consists of the Gillois Amphibious Bridge (named after its French designer) which is equivalent to the Mobile Assault Bridge — in US terminology it is known as the Amphibious River Crossing Equipment — the AMX 30 AVLB (63 foot span, Class 60). There are 8 AVLBs and 4 launchers at the Divisional Combat Battalion level and 4 AVLBs and 2 launchers per Brigade Engineer Combat Company.

At Corps level (2 or 3 Divisions):

One Combat Regiment, Corps type (888 personnel) with 1 HHC and 4 Combat Companies

Two Combat Support Regiments (1352 personnel each) with 6 Companies:

1 HHC, 1 Light Equipment Company, 1 Floating Bridge Company, 1 Transportation Company, 1 Amphibious Bridge Company and 1 Firemen Company.

In other words, a Corps of 2 Divisions has a total of some 7,500 Engineers.

The other Force Systems consist mainly of: One Combat Battalion (Airborne), Territorial Combat Battalions and infrastructure units such as: Railway Battalion and 4 Airfield Battalions capable of constructing, maintaining and repairing airfields of all types.

Equipment: At present, with the exception of some old US bridging equipment (Bailey and M4T6), French Engineers are equipped with French designed and built equipment. The most famous of these is the Gillois am-



phibious equipment consisting of 3 different models built on the same chassis and basic mechanical unit:

The ferry: Class 30 or 60 when coupled

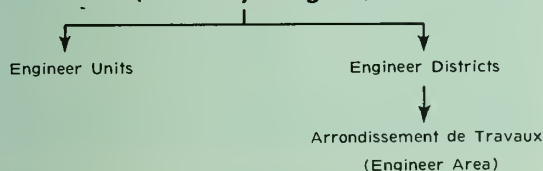
The amphibious bridge: Class 60 to 100

The self-propelled bridge (scissor type bridge, 66 foot span): Class 30 or 60 when coupled.

• Le SERVICE: (Military Construction:)

It is under the direct control of the Director (Directeur Central). The detailed control of building and maintenance is vested in the "Commander and Director of the Engineers" of the military regions (almost equivalent to the US Engineer Divisions, for the construction aspect only). Within every military region further subdivision of control is made and a typical layout would be:

Commander and Director of the Engineers (Military Region)



An 'Arrondissement de Travaux' is similar to an Area Engineer in the U.S. Army Corps of Engineers. He is in charge of either a large garrison town or a geographic group of smaller military installations.

At the "Commander and Director" and at the "District" level there is a technical department in charge of the design of new buildings and construction. The other administrative departments handle real estate, finance and contracts.

These departments are responsible to the higher level of the Engineer chain of command and to a larger technical department of the 'Directeur Central' called 'Section Technique Batiments Fortifications et Travaux (STBFT). The STBFT deals with the evaluation and approval of all new important designs submitted by the military region level and at times produces designs for major projects.

Before concluding, it would be appropriate to mention another Engineer school — "the Ecole Supérieure du Genie" at Versailles. This is a technical school for officers and non-commissioned personnel assigned to military construction. For example, it offers an 18 month course for young Engineer Captains (college graduates) which leads to the equivalent of a Masters degree in Construction.

• CONCLUSION

The French Engineers have a long and proud military engineering tradition in both war and peace. Since its inception in 1776, the traditional 'black and red' colors of the Corps and its Crest — the steel plate and helmet, have been in the forefront of major scientific and technical developments and have "led the way" for the French armies involved in wars all over the world.

A brief review of the roster of those who have passed through the ranks of the Corps reveals many famous names in French military and scientific history. Some of the prominent figures and their contributions are:

MARSHAL VAUBAN: Known as the 'father' of the French Engineers, he was a world renowned expert in both construction and fortification techniques.

GENERAL CARNOT: A member of the French Revolutionary Committee at the time of the Revolution, he was named "the organizer of the victory."

NICOLAS CARNOT: Son of the above, a mathematician and physicist (thermodynamics).

GENERAL BERTHIER: Chief of Staff of Napoleon's armies.

CLAUDE ROUGET de LISLE: Composer of the 'Marseillaise' — the National Anthem.

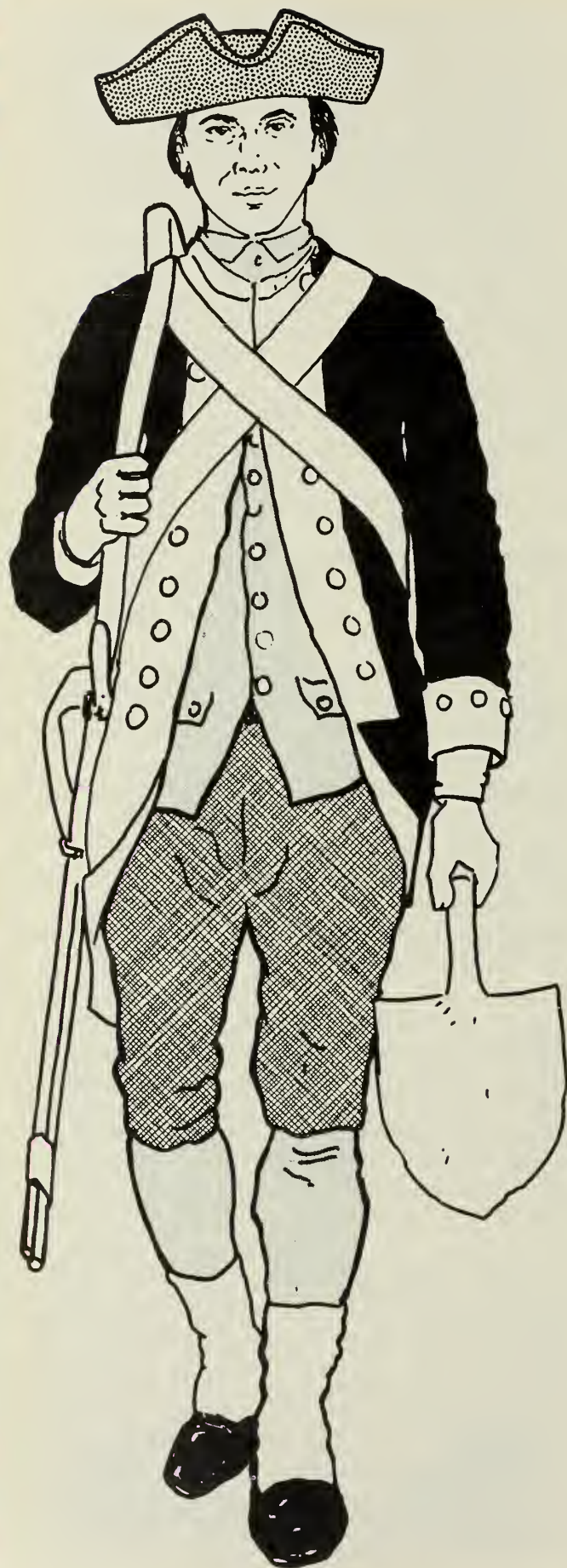
CHARLES COULOMB: Electricity.

GENERAL PONCELET: Mathematician and physicist.

MARSHAL JOFFRE: Commander, Allied Forces in World War I.

Now, 199 years after their 'refounding,' the motto the French Engineers — CONSTRUCT OFTEN, DESTROY SOMETIMES, SERVE ALWAYS, constantly serves to remind the Engineers that as in the past, so in the future, they will continue to constitute an integral force in the nation's defense system.

Army Lieutenant Colonel Henri C. Aiglon, Engineers (FRANCE), is presently District Engineer, Tours, France. He was the French Liaison Officer to the US Army Engineer School, Ft. Belvoir, Virginia from 1972- August 1975, served as a combat engineer in North Vietnam (1954) and Algeria (1961), and was an instructor at both the French Armor School and the French Military Academy. He is a graduate of the French Military Academy, St. Cyr and holds the French equivalent of a Masters degree in engineering.



The Forge

Present day officers of the Corps of Engineers are very familiar with the currently used "Es-sayons" button. This button has been definitely identified as being used in 1814 and may have been used in modified form as early as 1802 when a Congressional Act authorized the now familiar Corps of Engineers. But what, if any, did the Army Engineer officer wear as a uniform button prior to 1802?

Records of the Revolutionary War Period (1775 to 1783) do not reveal any distinctive type of button being worn by the appointed engineer officers. Engineers of that period wore either the button of their parent state with a state identification or the general service button. The regular Continental Army uniform button was either white or yellow in color with "USA" on the face.

In November of 1783, by act of Congress, the existing Corps of Engineers was mustered out of active military service along with the majority of

MAJ Francis Nataluk



FIG 1

ten Engineer Buttons

the remaining Continental Army. Regular forces by June 1784 (including engineers) consisted of two small "caretaker" detachments, one 25-man group at Fort Pitt and one 55-man group at West Point, and one commanding officer. However, in the same month, Congress authorized a small standing Army. This regular Army consisted of eight companies of Infantry and two companies of Artillery (no engineers were indicated in the organization).

By 1793, relations between Europe and the United States had deteriorated to the point where President Washington asked Congress for the authority to begin fortification of principal harbors along the East Coast. Congress granted this request in March 1794, and Washington appointed several engineers to supervise these coastal districts and the construction of forts and artillery emplacements. The uniform, and specifically its buttons, worn by these first "District Engineers" is not recorded. It is assumed by military uniform historians that these men wore the Artillerists uniform with some modification to designate them as engineers.

erists uniform with some modification to designate them as engineers.

In May 1794, a Corps of Engineers arm was added to the Artillerist Corps and the resultant "Corps of Artillerists and Engineers" (USA&E) was formed. Initially, these Corps officers wore the then existing Artillery uniform and a button (Fig 1) consisting of an eagle facing to the left, standing on a field piece which pointed away. This button was quickly replaced in the same year. The button worn by the USA&E can be found in four variations involving the absence or appearance of regimental markings above the field piece. Shown here is the third variation, inscribed with the markings of the 1st REG to set apart the wearer from the 2d REG, similarly marked. Of the other two Corps of Artillerists and Engineers buttons, one had only the USA&E in script below and the other was similar to Fig 2 except for the absence of the designation "1st" or "2d" before the word Reg't. The second regiment and consequently the 1st and 2d Regiment identification were authorized in April 1798.

Buttons of the general design of Fig 2 were worn by Engineers until 1802 when the Corps of Engineers was separated from the Corps of Artillerists. From then until 1814, the records do not identify any distinctive buttons on the engineer's uniforms. Uniform historians surmise, because of the small number of affected officers (20), these men wore the current Artillery button or the older USA&E button. By 1814, the Essayons button was being worn by officers at West Point Academy as noted by General D. Ramsey. In 1902, when the Army adopted regulation buttons, the Corps of Engineers alone was allowed to retain the distinctive button. It has remained essentially unchanged in appearance since 1814.



FIG 2

Major "Mike" Nataluk is a USAR officer on a STEADFAST tour of duty with the US Army Engineer School at Fort Belvoir. He has served in a number of Engineer units, both active and reserve and is a graduate of the Command and General Staff College at Fort Leavenworth, Kansas. His interest in early Engineer history came as a follow-on to working with Reserve and National Guard units, many of which have lineage dating back to Revolutionary and pre-Revolutionary days.

Combined Arms team River Crossing Operations

Working under the cover of darkness and following the philosophy "if they can see you, they can kill you", engineers of the 7th Engineer Brigade and members of the VII Corps combined arms team learned that river crossing operations can be conducted successfully and without major difficulties.

In a series of exercises during April 1975, the 7th Engineer Brigade conducted river crossing training and four, 3 day combined arms retrograde river crossing FTXs on the Main River near Kitzingen, Germany. The exercises provided a unique opportunity for engineers and members of the combined arms team to practice and develop techniques for conducting night river crossing operations in hostile environment. While some new concepts resulted, many of the lessons reaffirmed established techniques and doctrine.

The objectives of the exercises were threefold; one, to allow the engineers to train with all the Corps' float bridge equipment; two, to exercise the combined arms team in a situation requiring limited daytime movement and a night retrograde river crossing; three, to develop experience and lessons learned to expand current retrograde river crossing doctrine.

The Admin Portion

In preparation for the FTX, each of the four combat engineer battalions of the 7th Engineer Brigade underwent three days of refresher training with river crossing equipment. The training days were long and allowed for both day and night

training. To prepare for the FTX, each unit made maximum use of integrated training and devoted its major effort on the heavy bridging — CL 60, M4T6, and the M-2 Bailey Bridge.

Each unit realized early in its training cycle the importance of cooperation between "supporter and supported." The close coordination thus fostered during the training cycle helped each unit to accomplish its FTX missions with minimum delays.

The FTX Portion

The FTX was designed to force intense but realistic utilization of the entire spectrum of river crossing capabilities. The engineers were required to support combined arms tactical crossings in "real" time based on realistic enemy and friendly situations. The bridging and crossing sites available were matched to the actual number of vehicles and tactical plans of the crossing area commander. Controllers did, however, limit the bridging available to that which would normally be available to a crossing area in the Corps zone.

Each scenario was tailored to the specific tactical crossing unit. Because the crossing units varied from a Pershing artillery battalion, to a cavalry squadron, to mechanized infantry, each river crossing scenario was tailored to the crossing unit. Each scenario assumed the loss of air-superiority shortly after the outbreak of hostilities, and each involved a retrograde river crossing. Tactical commanders functioned as crossing area commanders (CACs) and were required to prepare crossing plans for bridging on the first night and rafting the second. The rafting operation was

forced through a withdrawal of heavy bridging to the rear plus the proximity of enemy forces. Every CAC was supported by a combat engineer battalion of the brigade plus float bridging from the 565th Engineer Battalion (Composite). In addition, each CAC had MP support for traffic control, ADA (Chapparral/Vulcans), and smoke from a section of a labor service smoke generator company. To realistically portray the lack of air superiority, the CAC was opposed by high performance aircraft and attack Cobras from the 3d Combat Assault Bridge.

Reaction to the Loss of Air Superiority

Of all the lessons learned, the reaction to the loss of air superiority was the most interesting. The initial reaction by the engineer units was to refrain from any movement or activity whatsoever during daylight hours for fear of enemy air attack. However, time restraints and pressure to accomplish the mission forced a re-evaluation. As a result, work proceeded by limiting vulnerability and presenting only small targets (targets which the enemy would not risk a million-dollar aircraft to destroy). Further, the effectiveness of the Chapparral/Vulcan battery against enemy air was sufficient to provide increased confidence to all the crossing elements and mission work progressed with few delays. After the bridge crossings were completed the first night, the engineers were required to remove the bridge completely or place it along the river bank. Each engineer unit elected to disperse the bridge; however, the dispersion undertaken was usually insufficient. Due to the large bomb load capability of enemy aircraft and their ability to bomb at set intervals, the bridge parts should have been spread at least 100 meters apart and at uneven intervals. Other options were to tie sections together and camouflage to represent an island or beached debris.

The engineer units soon learned the value of clearing the bridge construction site of all unnecessary vehicles. Besides presenting a much smaller target, operations were greatly improved by reduced congestion. In most cases, vehicles returned to the bridge park. An alternate course, suggested by the Air Force participants, was to park the vehicles in geometric patterns next to a village. Infrared detection devices would easily spot the hot exhausts against the cool background of woods, but the image would be indistinguishable from the village itself. However, such vehicles had to be moved or well camouflaged before daylight.

Constructing the bridge and conducting the crossing under blackout conditions disturbed several commanders from a safety and operational point of view. Their fears were unfounded as all four crossings were successfully conducted with little lighting. Crane lights and hand-held flash-

lights were the only lights used to construct the heavy bridge and rafts. Light tactical raft and footbridges were installed using only covered flashlights. As an illustration of the light discipline achieved, aggressors who were less than one kilometer away were unaware of the light tactical raft and footbridge construction. While some crane lights were visible from that distance, the type activity remained unclear.

With a smoke generating capability available, each unit was quick to request its maximum utilization. Unfortunately, administrative restrictions limited the use to one or two hours during the morning and evening. The smoke generating units capability to "haze" an area proved as effective as dense smoke and created better construction working conditions within. Smoke, in general, has an adverse effect on the Vulcan/Chapparral unit which is dependent on visual observation for target detection. Lastly, an interesting observation was made by Air Force representatives concerning the use of smoke and terrain analysis. As the valley utilized for the crossing was very similar to an adjacent valley, smoke could have been used solely in the unused valley as a deception. Such a deception would have allowed the ADA to operate with unlimited visibility as a bonus to the ruse.

Retrograde River Crossing Doctrine

The exercise clearly demonstrated that a retrograde river crossing is NOT simply a hasty or deliberate assault river crossing in reverse. A noticeable distinction arises in the area of command and control, since the crossing area commander (CAC) will change depending on the location of the crossing area on the battlefield. A few items should be highlighted:

- Crossing area forward of the brigade rear boundary. Uncertainty as to the specific identity of the CAC in a retrograde is thus introduced by enemy action and friendly response through maneuver, an element missing in the assault river crossing. This situation more closely represents the current doctrinal approach where the senior tactical commander is the logical person to control the crossing. To prevent his tactical plan from being subordinate to the crossing plan of another commander, he must be the CAC. Considering the nearness of enemy action, the crossing plan must be closely integrated with the tactical plan and the placement of crossing area control under one commander is paramount. The CAC retains this control until the area is cleared of friendly troops and removal or destruction of the bridges/rafts is complete. Support elements (engineers, MPs, ADA, smoke) are in direct support of or attached to the CAC during the crossing.

- Crossing behind the brigade rear boundary.

Unlike the situation described above, these areas will probably undergo several changes in crossing units throughout their existence. Furthermore, there may be numerous units crossing in both directions which may or may not belong to the local senior tactical commander. Therefore, it seems that the local senior engineer should be the CAC for the duration of the crossing or until the crossing area falls within the brigade rear boundary. Support elements should thus be attached (MPs, smoke) or in direct support (arty, ADA) for the life of the crossing area. This degree of permanency allows the CAC to establish a crossing area to accommodate multi-sized units crossing in both directions. The tactical commander then merely communicates with the engineer CAC when he wants to cross. The actual movement must be cleared with the Corps MCC (Movement Control Center), but the specific crossing time should remain the prerogative of the engineer CAC. Location of CAC headquarters and radio frequencies must be given wide dissemination to units expected to cross.

- Location of the CAC. Proper location of the CAC and the support element commander, to include the engineers, is important for the overall control of the crossing area. In general, all CACs involved in this series of exercises located their CPs at the staging area or near the crossing site. During the crossing, most moved to a location directly on the river. Since most crossings occurred at one site, this was best. However, this would have been unadvisable had more than one site been operational. The support commanders tended to stay too near their headquarters and allow liaison officers to effect the close coordination. In only one case did an engineer commander elect to move a jump CP to the same area as the CAC. Coordination would have improved had the unit possessed sufficient communications equipment to remain in close contact with its own subordinate elements. As it was, the overall effect was disruptive to control. Therefore, unless the engineer is the CAC, movement of the engineer and support CPs to the vicinity of the CAC is not recommended.

- Artillery support. Artillery support was included in the exercise, but crossing commanders failed to include the integration of artillery support in their crossing plans. Artillery support in a retrograde crossing is essential, particularly during the latter phases of the crossing in the brigade sector. Artillery and ground dispensed scatterable mines could assist considerably the last elements in crossings and could delay the enemy while engineers move tactical bridging or destroy the remaining bridging and equipment.

- Communications and electronic warfare (EW)

During the administrative phase, engineer troops integrated CBR with Bailey Bridge construction.



The exercises proved several firsts, including the first Pershing Missile erector-launcher to cross a tactical bridge (7 April 1975.)

The first M-60 Tank crosses a combination M4T6-Class 60 bridge during the pre-dawn hours.



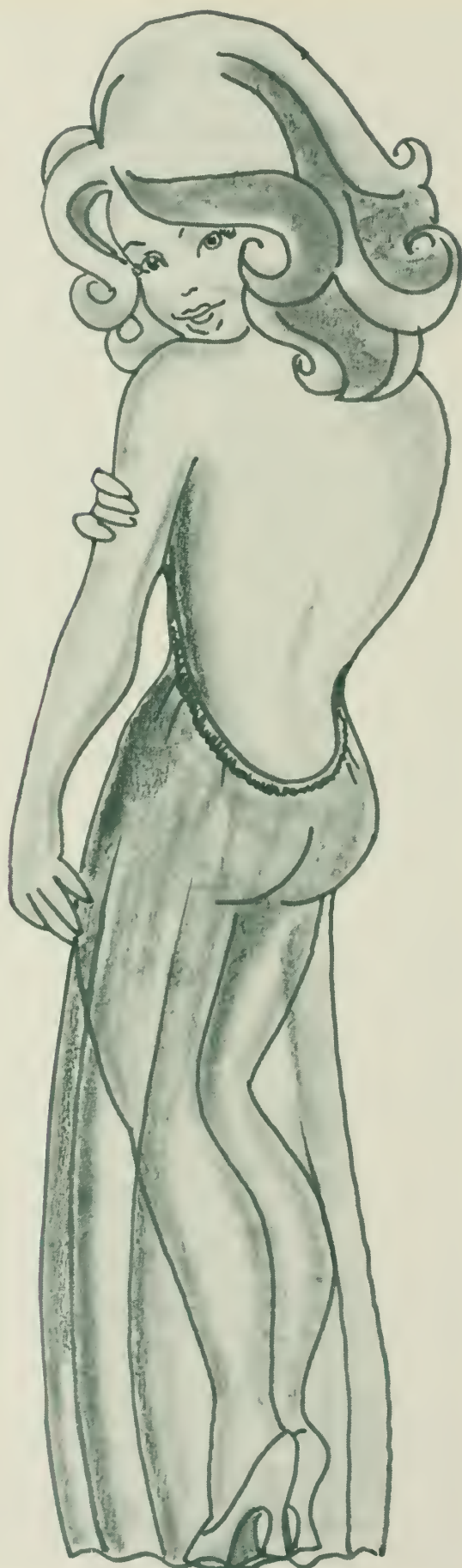
Class 60 Raft still plays an important role in vehicular movement.

considerations. The high number of radios utilized during the crossing caused a definite EW problem which was never solved during the exercise. The concentration and frequency of use was controlled somewhat, but not to any large degree. However, several actions taken by the units in an attempt to reduce emissions were significant. In one case, a separate and specific CEOI (communications-electronics operating instructions) was prepared and insured the assignment of all call signs and frequencies to all assigned or attached or DS elements. Another approach was to utilize listening silence during the crossing. The tactical units conceivably could comply with this arrangement, but the military police had to sacrifice traffic control for fewer emissions. As a result, the MPs disregarded the direction and accomplished their traffic control mission. A third approach is to direct radios to low power sufficient to cover only the area of operations. Low powered radios were also needed at the raft sites during the hours of extreme darkness, as traffic tended to be unevenly distributed. A low powered radio at each site, controlled centrally by the engineer-in-charge, would have contributed significantly to even traffic flow. Lastly, the use of wire and field phones was never considered due to the large number of tracked vehicles and the administrative problems of laying wire. The use of wire remains a reasonable solution to the problem, particularly at rear area crossing sites.

The exercise was instrumental in emphasizing the role of the engineer on the combat combined arms team in VII Corps. It forced the combined arms objective and provided realistic bridge/rafting construction and crossing experience for a large number of units, including the "first" Pershing missile erector-launcher to cross a tactical bridge. The April Bridge Training Exercise was indeed river training — European style, a style to be repeated often with new and better equipment and concepts.

Major Wain W. Stowe is presently S-3, 7th Engr Bde. He attended the Command & General Staff College in 1974 and has since been assigned to Europe. Previously, he was the Operations and Training Officer of the brigade. The FTX portion of the exercise outlined in the article was authored by him.

Captain William F. Greene is currently S-3, 565th Engr Bn. He has been in Europe since 1973 and was responsible for the Administrative portion of the exercise outlined in the article. He has authored several articles in other publications describing innovative approaches concerning the utilization of Class 60 and M4T6 bridges.



ADVANCED GETS INVOLVED

MAJ William L. Jones

For the past year and a half, officers attending the Engineer Officer Advanced Course (EOAC) at Ft. Belvoir, Virginia have participated in numerous combat-development, doctrine-development, and training-development group seminars for elective credits. The goal of the elective program has been to provide meaningful problems to expose students to the Combat and Training Development (CTD) process and to capitalize on the students' past experiences.

Projects were selected from a list of critical subjects being worked on by the resident CTD staff. Over 50 projects, running the gamut of the CTD mission from conceptual studies for the near future to training program design have been initiated or completed. All projects are original work and only general guidance is provided by CTD staff advisors.

The unstructured format, internal organizational requirements, and problem definition posed a challenge and provided a change of pace from the usual structured classroom environment. For many officers, this was the first opportunity to participate in a staff working group where results were expected and the work group had to collectively determine what should be done.

The following are a few of the projects the EOAC students have worked on:

COURSE LVED

Task Analysis of the Construction Battalion:

The analysis laid much of the ground work for what later became a concept for employment of the engineer combat battalion (heavy). In addition, it provided the foundation for ARTEP 5-115, which was printed as a test document in April.

Camouflage Move Script—Two scripts were written and color TV tapes prepared, published and distributed.

Scenario Oriented Recurring Evaluation System (SCORES) Participation: The student group was required to make a terrain analysis of a specific 100 square kilometer area in a selected part of the world. The group found that current map products were inadequate. Shortfalls in the Army Terrain Intelligence System were surfaced. System changes were proposed to reduce the problem.

Engineer Squad Vehicle (Mech): What vehicle can best fill the needs of the mechanized engineer squad? Students examined prototypes and the full family of vehicles used. Size, crew production, capabilities, and maintenance were evaluated and the group recommended the M548. Substitution in part for M113s is being recommended by the Engineer School based on this analysis.

Universal Brigades and Group Headquarters: Now that the construction battalion takes on a combat mission, can construction and combat headquarters be made common? If so, what should the organization contain? A student group conducted the analysis, briefed the Engineer Center Team, and actively participated in the TOE 5-52 and 5-101 design. Both are currently undergoing review. Concurrently, an ARTEP for each headquarters is being developed by USAES to more clearly delineate the functions of each headquarters.

Training Packet Design: There is a need in the field for support of ARTEP task training that will

reduce lesson preparation time and facilitate decentralized training by junior leaders. Students developed a highly illustrated pamphlet aimed at the squad leader including a "Tips to the Trainer" section with instruction for the leader in conducting effective and efficient training. The pamphlets are printed locally at the Engineer School and are available through the Department of Army-Wide Training Supprt (DAWTS), USAES, Fort Belvoir, VA. 22060.

Winterization of Civilian Construction Equipment (CCE): What modifications in equipment or procedures will best support units employing CCE in arctic regions such as Alaska? Student research of civilian practices revealed in many cases that training or cold weather procedures combined with minor equipment modification often were more cost effective than more complex equipment modifications. Results will be staffed and programmed into future procurement actions.

Engineer Sets, Kits and Outfits: How adequate are engineer tool sets? What changes need to be made in procedures to routinely modernize components? Students recommended significant changes in procedures for review of sets kits and outfits (SKO) to TRADOC. Subsequently the Logistics Center developed and sent to various schools a comprehensive list of SKOs for review and comments. The majority of the student recommendations are expected to be adapted in new procedures being written now.

The above samples show the range, depth and utility of the EOAC seminars. Different groups receive different exposure, but collectively they gain an appreciation of the complex problem of enhancing the Army in the field. The fresh ideas and challenging attitudes of the EOAC students provide positive stimulus to the CTD community, and, above all, bring to bear on this problem the perspective of the company leader. The students also learn what CTD does and how the service school model works, thus better understanding how change can be accomplished. Further, students learn how to work within non-structured peer groups with only general direction and ultimately deliver a formal decision briefing.

Major William L. Jones is currently Chief of Regulatory Functions, Baltimore Engineer District, Baltimore, Maryland. He is a graduate of Norwich and Missouri Universities and of the Engineer Officer Advanced Course. He has served as a Combat Engineer Company Commander and as a Battalion Executive Officer in both Germany and Vietnam. His last assignment was as Chief of Unit Training for ARTEPS, Doctrine and Training Developments Division, USAES, Ft. Belvoir, Virginia.



CPT Charles C. McCloskey III

The BEST Way to Train

The basic fighting engineer unit in the United States Army is the combat engineer battalion. A combat engineer battalion is organic to every Army division, present in Army corps, and found in theater armies. The value of the combat engineer battalion to today's Army is proved not only by this inclusion in division, corps, and army TO&Es, but by the fighting combat engineer heritage and outstanding combat engineer performance record in past American wars. The basic premise is that an effective Army must have combat engineers. The corollary is then that the combat engineers must also be effective. To be effective they must be well trained.

In today's Army, how should this be done? Recent years have seen the Department of the Army promote decentralized training; intended or not, the training load was put squarely on the shoulders of the company commander. The Army in the field was told that the company commander, because he is so close to his unit, can best determine the training needs of his men, can best plan training, can best execute training, and can

best evaluate training. Although these statements have much validity, they gloss over three very important facts:

- The company commander has many other mandatory demands on his time which limit the time he can devote to planning and executing training.
- The battalion commander bears primary responsibility for his command's combat readiness, training being a major if not the most important factor in this readiness.
- A full-time battalion staff, particularly the S-3 section, exists to serve the company and battalion commanders.

So while not diminishing the primary importance of the company commander's role and judgment, means do exist within the combat engineer battalion to assist him in training his unit better than he could do it by himself, namely the experience and guidance of the battalion commander and the expertise and time of the battalion staff.

An Army cliché which is probably said, in a negative way, several thousand times a day is "reinventing the wheel." Before continuing, it should be stated that the training system proposed here is not novel or pioneering. But rather than "reinventing the wheel," more correctly it gets back to fundamentals. Under this system, tasks outlined for commanders and staffs in FM 101-5, "Staff Organization and Procedure," and similar doctrinal publications are done by the personnel designated to do them. The company commander is not forced to do everything himself. And the guidance found in TC 25-5-1, "Training Management: An Overview," is followed. The battalion commander functions as the training manager for his battalion.

Definition

The BEST way to train a combat engineer battalion is a Battalion-administered, Economic, Systematic, Testing Program. This program is formulated by the battalion commander and staff, developed and directed by the battalion operations section, and implemented by company personnel and the battalion staff. The BEST program economizes on company time, leaving the company commander free to set priorities among conflicting missions while insuring him that his unit will be periodically tested on its ability to perform basic individual and combat engineer missions. The BEST program is systematic, built on a cyclical time frame and progressing in scope from the individual level to squad, platoon, and company. The BEST program is a testing program which evaluates each element of the command on its ability to accomplish its mission and provides the

battalion and company commanders alike feedback on training strengths and weaknesses.

How To Implement The BEST Program

The first step in implementing the BEST program is to allocate time. A training cycle must be selected — say 6, 12, or 18 months, or whatever the battalion commander feels is appropriate. Having selected the cycle, it is next divided into four phases: individual, squad, platoon, and company. Next, specific time periods at the end of each phase are set aside for testing, scheduling around known future requirements.

The second step is for the battalion commander to determine the training needs for each phase. He meets with the battalion S-3 and together a determination of needs is made based on:

- Wartime mission requirements;
- Army training requirements as specified in FMs, TMs, ARTEP 5-35, command directed training, and other appropriate training references;
- Special mission requirements; and
- The battalion commander's evaluation of the training status of the battalion.

The cyclical training program has now been blocked out, and the training needs identified. They are published and distributed to company commanders and the battalion staff for use in their planning.

The next step is to plan each test. The planning should begin at the conclusion of the previous phase's testing or earlier. The scope of the test is developed — how many missions, how long, what support will be required, the type and number of training sites. Then coordination is done, primarily in the S-3 section, to bring the concept to reality.

Out of this work comes a **letter of instructions** (LOI) to company commanders and the battalion staff. The LOI gives details, requirements, and time schedules of the test. Assignments as test site evaluators are distributed evenly among all line units, with the battalion staff supporting as necessary.

The detailed planning of each test station, to include lesson plan, scenario, and score sheet, is done by the evaluator and monitored by the S-3 section. This is significant because it not only greatly expands the capability of the battalion to conduct a comprehensive test; it also broadens the military education and experience of all evaluators by charging them with the development and execution of a test.

What is the company commander doing in the meantime? He is setting priorities among all assigned tasks and accomplishing them in the best manner possible. He is training his company in

accordance with the battalion commander's guidance and based on his own assessment of the company's training needs. In the back of his mind he knows that company training must have a high priority so that the company is ready for the test which comes at the end of the phase.

The next step is execution, the taking of the test by individuals or units. Test progress is monitored by the battalion commander and his staff. Results are collected and tabulated by the S-3 section and high scoring individuals and units are recognized and rewarded. A side benefit of the testing is that it often turns out to be the best training the individual or unit has had during the phase, for conflicting priorities often prevent training in certain subjects during the phase.

The final step is evaluation. Both the test results and the test are studied to determine the training status of the tested units and the effectiveness of the test. Recommended improvements for training of units are passed on to the company commanders for incorporation into their training programs; recommended improvements for testing go back to the S-3 for incorporation into future tests.

Why The BEST Program?

What makes the BEST program better than fully decentralized (company controlled) training? There are many reasons.

First, the battalion commander best understands the battalion's mission. He, better than anyone else in the battalion, knows what particular missions his units must be capable of performing. He knows, for example, whether it is more important to concentrate on bridging, demolitions, reconnaissance, or infantry tactics and the relative weights to assign to each. Thus he can tailor training for combat readiness better than the company commander.

Second, the battalion commander has a better grasp of the total training situation. He knows what conflicting missions — such as construction projects, major field problems, and guard commitments — are expected and can schedule the testing around them. The company commander frequently cannot do this and the consequence for him is cancelled company training.

Third, the battalion commander, through his staff, has better access to the resources essential to good training. These include training areas, training ammunition, special equipment (such as bridging, assault boats, or cranes), and support personnel (such as equipment operators, special skills personnel, and other military units). The staff has this access as part of their normal duties and it is far more economical for one staff section to gather training resources than four or five company commanders.

Fourth, the staff can devote the time necessary to develop sound, thorough, and meaningful tests. Compared to the company commander, the S-3 section has far fewer competing time demands and thus can stay with the BEST program from beginning to end without interruption. This, too, economizes on company commanders' time.

Other factors which are significant in recommending the BEST program are:

- Training standards can be set and enforced uniformly throughout the battalion;
- The majority of the coordination is done at the battalion level;
- The maximum number of units receive at least the minimum essential training;
- The company commander is still free to train his unit as necessary — only four training weeks of a yearly cycle are set aside for testing.

Alternatives

Major alternatives to the BEST program are fully decentralized training (training planned and executed strictly at company level) and committee training (training conducted by selected individuals detached from their normal duties in order to plan and execute training for the battalion).

In favor of fully decentralized training is the fact that the company commander best knows the current status of his unit and can tailor training to counter its weaknesses and exploit its strengths. Also, fully decentralized training promotes self-education by chain of command members. Further, fully decentralized training must be employed in certain situations such as separate combat engineer companies and widely dispersed companies within battalions.

On the other hand, companies do not have easy access to all resources necessary for good training; they lack the training expertise and experience found in the battalion staff; and they do not have the overall picture of the mission requirements of the battalion.

Committee training has the advantages of providing well-planned, well-rehearsed training for all units of the battalion. It, too, removes much of the training burden from the company. Also, it allows the battalion commander to set and enforce standards of training throughout the battalion.

The major disadvantage of the committee system is that it disrupts the chain of command by taking key personnel (platoon leaders, platoon sergeants, squad leaders, and section leaders) out of their normal jobs for extended periods of time and thus renders and company chain of command less than fully effective.

Of course, in certain situations, the committee system is the best possible system. The best examples of this are basic training, advanced

individual training (AIT), and initial unit training after activation. In these cases, however, the training is accomplished prior to the individual or unit having an operational mission.

Case Study — The 237th Combat Engineer Battalion

Does the BEST program work? Indeed it does. The 237th Combat Engineer Battalion, a VII Corps unit belonging to the 7th Engineer Brigade and stationed in Heilbronn, Germany, has been using this system since October 1973 with outstanding results.

In 1973, the battalion commander of the 237th was faced with the problem of keeping his battalion combat ready while simultaneously having all troop barracks and the dining facility rehabilitated, accomplishing many construction projects for the community, performing security missions at ammunition supply points, and participating in several brigade and higher directed projects, programs, and field problems. Company commanders routinely saw their well-prepared training schedules go out the window with last minute priority changes and crash projects. The only way the battalion commander could systematically accomplish all assigned missions and maintain combat readiness was through a well-planned training program which took into account the other requirements levied on the battalion. This then was the impetus for the BEST program.

The initial cycle was set as the calendar year. The year was divided into phases as follows:

Jan-Feb - Individual
Mar-Apr - Squad
May-Jul - Platoon
Aug-Dec - Company

The longer phase for company testing allowed for slippage in the other phases. Training guidance and goals were established and the program was published and distributed to all units.

Individual, squad, and platoon testing were all accomplished with outstanding results. Company testing was combined with REFORGER 74, a major U.S. Army Europe exercise, and likewise produced outstanding results. An almost tangible change came over the battalion as combat readiness and morale picked up. The chain of command was strengthened, and the company commanders were better able to set their priorities and train their companies.

Minor problems in implementation the first year were in developing the tests, securing necessary training areas and waterways, and scheduling around large construction projects. Unfortunately, all units did not receive all the testing because of higher priorities on some construction.

Planning for the 1975 BEST program began in fall 1974 with the formulation of revised testing concepts and goals and the submission of proposed dates for testing. The program was again published, this time with better information on training facilities and resources available, training standards, and well-defined training goals.

The succeeding battalion commander modified the testing program to incorporate the lessons learned of the previous year and to reflect his assessment of the battalion's state of readiness to accomplish its assigned missions. With the experience of 1974, test results in 1975 improved dramatically. Competition among participants was keen, morale continued to rise, and the combat readiness of the battalion steadily improved.

Results of the BEST program in the 237th Combat Engineer Battalion based on almost two years of experience are as follows:

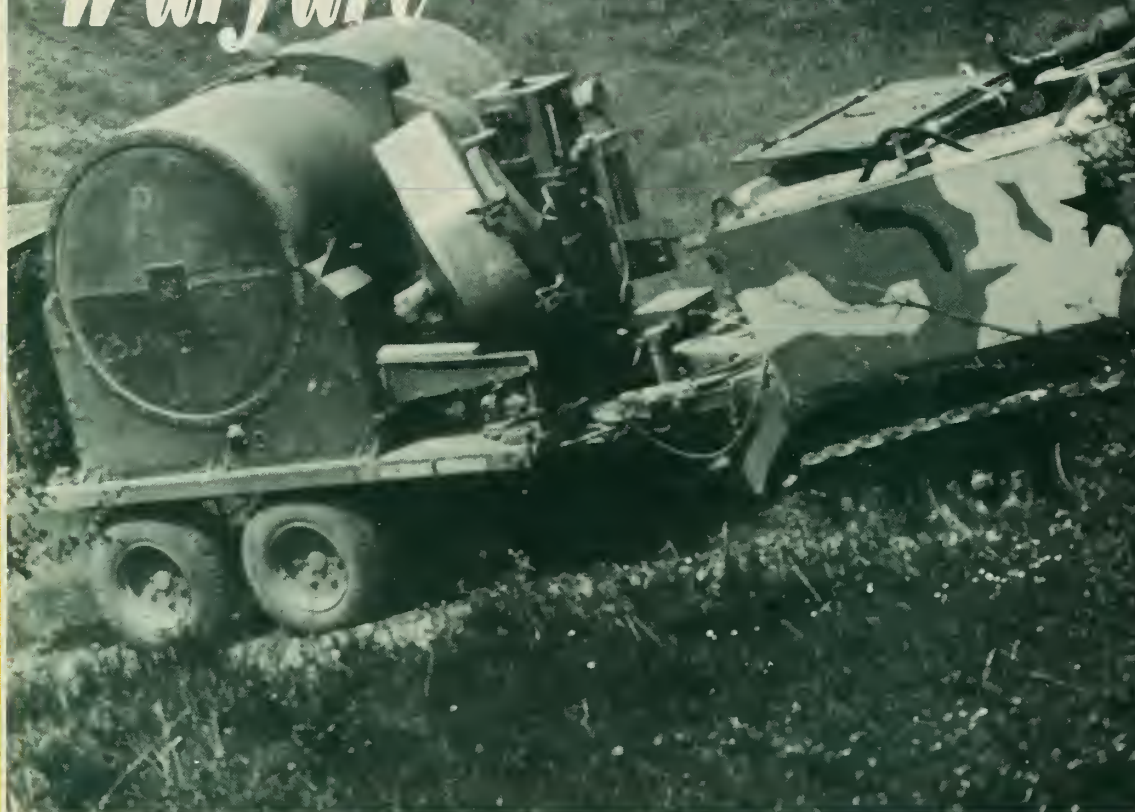
- Continual combat readiness appropriate to the assigned wartime mission.
- Excellent testing programs which provided for at least a minimum standard of training.
- Increased individual and unit skills.
- Increased staff and section competence through realistic support.
- Accomplishment of other assigned missions without disruption of the training schedule.
- Recognition of outstanding individuals and units.
- Identification of areas of training weakness.

The BEST program is a viable means to achieve and maintain combat readiness in a combat engineer battalion. It is based on a planned training cycle, divided into phases, and integrated with the battalion's other missions and requirements. It is administered primarily by the battalion S-3 and executed by personnel of the companies and the battalion staff. It allows the battalion commander to bring his experience and knowledge to bear on the training of the battalion and it allows the battalion staff to effectively assist.

Remember, the basic engineer fighting unit is the combat engineer battalion. To keep these battalions and thus the Army combat ready, BEST is best!

Captain Charles C. McCloskey III was the Operations Officer of the 237th Engineer Battalion (Combat) from 1973 to 1975. He is a USMA graduate and obtained an MS degree in Civil Engineering from Cornell University in 1971. He commanded a combat engineer company in Korea, served as an aviator in Viet Nam, and was a Resident Engineer in the Baltimore District. He is a graduate of the Engineer Officer Advanced Course and is a registered professional engineer in Virginia. Captain McCloskey is presently assigned as Assistant S-3, 7th Engineer Brigade.

Mines in Mechanized Warfare



LTC Joseph Pratt

Throughout the history of mechanized warfare, landmines have played a significant role in assisting a numerically inferior force to fight an effective battle. Mines are the primary means of creating artificial obstacles in the battle area and are a key component in the combat capability of the Combined Arms Team. The key function of mines is to enhance the effects of friendly fire by disrupting and inhibiting an enemy force. The development of optically-guided antitank missiles has further increased the requirement for and the potential effectiveness of minefields. The TOW or DRAGON tracker must remain "locked on target" for a definite period during missile flight, thereby increasing the need for an obstacle such as a minefield to delay the tank in the "window." The minefield; therefore, must not be considered in isolation, but viewed in concert with other weapon systems and its ability to improve the effectiveness of the Combined Arms Team.

The procedures and organizations for employing conventional mines have not changed significantly since World War II. Generally, mining has

been an engineer function, assisted by the other combat arms. Tactical units at the company or troop level have capabilities for hasty protective mining for close-in unit defense. Larger scale mining is normally planned and directed at brigade or division levels and usually consists of a series of small-point minefields around craters and tactical minefields hundreds of meters wide. However, this large scale use of conventional mines requires extensive expenditures of manpower, creates a significant logistical burden and must be planned and emplaced well before the battle develops and the enemy commits his forces.

The introduction of the family of scatterable mines (FASCAM) will produce significant changes in mining procedures and U.S. mine capabilities and should eliminate or reduce many of the problem areas indicated above. Throughout the FASCAM development program, a primary objective has been to identify and develop a variety of delivery means for scatterable, self-destructing (SD) mines which permits the widest application of combat power enhancement.

The XM128 Ground Vehicle Dispensed Mine System (GVDMS) and the M-56 Helicopter-Delivered System are being developed to provide a rapid means of mining in friendly areas to strengthen defensive positions and deny key avenues of approach. These systems will provide a rapid method of emplacing the pre-planned minefield in friendly territory, using a mine with a long self-destruct period (e.g., greater than 24 hours). The GVDMS mines are approximately a fifth the size of the M-15 and will be packaged to simplify loading and handling.

The Artillery-Delivered Mine System, XM718/741, is being developed to provide an indirect fire means for emplacing mines dynamically in response to enemy movement. The mine round will be fired by the standard 155mm Howitzer ranges up to 17km. Artillery-delivered mines offer a significant increase in mining capability and flexibility to the maneuver commander; however, competition for artillery tubes and the firing rate limit the number of mines which can be emplaced in a short period of time.

To provide a very rapid, short-range, indirect delivery system, a mine round is being developed for use in the rocket launcher of the Surface Launched Unit, Fuel Air Explosive (SULFAE) countermine system. This rocket system will be capable of delivering 700 to 800 mines a range of three to five kilometers in less than a minute. It will be assigned to the divisional engineer battalion with a required capability of delivering a minefield within 10 minutes. In order to be this responsive, the combat engineer company supporting the brigade will employ the system.

These systems will be augmented by U.S. Air Force Tactical Air-delivered mines for interdiction mining and close support of ground forces.

Dynamically-delivered mines will have a variety of self-destruct times ranging from a few hours (artillery, rocket) to several days (artillery, Tac Air).

Minefields, both conventional and self-destructing, are a part of the overall concept of the operation and are the tactical planning responsibility of the G-3 or S-3 of the appropriate headquarters. The engineer supporting this unit will normally undertake the detailed planning and act as advisor to the commander for mine warfare. The introduction of the family of scatterable mines will create significant changes in operating procedures. The engineer will remain the primary planner, but the mines may be delivered to the battle area and emplaced by a variety of delivery means allocated to non-engineer units.

While this will greatly increase the mining capability available to the tactical commander, it will create operational problems in the allocation of delivery assets, and control of the mined areas through marking, reporting and recording. During normal operational testing a variety of employment procedures will be evaluated to determine the most efficient method for each system. Conventional minefields will still be marked by barbed-wire fences. Since scatterable mines self-destruct, less permanent means of marking should be adequate. The XM133 Rapidly emplaced Minefield Marking System is being developed for the purpose of marking minefields emplaced by the Ground Vehicle and the M-56 Mine Systems. Mines delivered into hostile or disputed territory by artillery, rocket or Tac Air will not be marked, but the mined area will be recorded at division or brigade headquarters on the operations map. This information will be provided to lower levels as appropriate.

It is evident from testing performed by the Scenario Oriented Recurring Evaluation System (SCORES) and gaming done in support of anti-armor doctrine that scatterable mines are adding a very significant new dimension to mechanized warfare. All combat engineer leaders must be prepared to fully exploit this dimension and improve the effectiveness of the Combined Arms Team in "winning the first battle."

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Platoon Proficiency Training

Captain John J. Connor



PROFICIENCY AT THE CUTTING EDGE was the theme of a recent letter on training issued by General Bernard W. Rogers, FORSCOM Commander. The letter directed that this theme be the central thrust of all training during FY 76. In response to his training guidelines, the 39th Engineer Battalion (Combat) set out to determine the proficiency of its line platoons by conducting a series of six 8-hour graded practical exercises based on ARTEP 5-35.

The exercises were completely tactical throughout, and the platoon leaders were graded in several areas which included leadership, work force organization and technical proficiency. Reference material was allowed. Six areas were chosen for testing: Bridging, Rigging, Field Fortifications, Demolitions, and Tactics, plus a "Composite Station" which included Communications, Maintenance, and eight other subjects.

The six stations were directed by members of the battalion staff, with support personnel from the Headquarters Company. Unit commanders had no active role, but kept busy observing and discussing their platoons' performance with the graders.

Prior to the start of the exercise, the Battalion Commander summed up what he hoped PPT would accomplish: "When we evaluate the results, it will allow us to tailor the training of each platoon to strengthen its weak areas. We can then

run a second cycle to provide much keener competition among the platoons."

Of course, the format used by the 39th can be modified to accommodate other units' needs and local training facilities, but here is a look at PPT as conducted by the "BLUE BULLS."

STATION 1— BRIDGING. Here the platoon leader was faced with three tasks. First he had to **design** a timber trestle bridge, including the substructure; second he had to **construct** it; and third, he had to layout and construct a Bailey



Bridge across a dry gap. The station also integrated camouflage, security and NBC training into the exercise.

The timber trestle bridge was a Class 50, single lane with three bents. It was to be constructed with native deck and posts, cut stringers, caps and sills. At this station, work force organization was the key grading factor.

STATION 2 — RIGGING. The purpose of this station was to make the platoon leader "think rigging." The central project was the erection of shears on both sides of a pond, with a high line to ferry equipment and personnel across. Each platoon accomplished the mission differently. Several minor tasks were also given, and it was here that the strengths or weaknesses of a platoon became evident. The utilization of manpower and material in an efficient manner to accomplish multiple missions simultaneously was perhaps the most valuable lesson learned.

STATION 3 — FIELD FORTIFICATIONS.

At this station, the platoon was required to accomplish 18 separate missions related to defensive operations, such as mine counter-mine operations, emplacements, camouflage, fences, ADM and barriers. The platoon leaders were given little specific guidance from the station OIC and were expected to choose the best types of and locations for effective obstacles. These multiple tasks again strained the chain of command and spotlighted the squad leaders and assistant squad leaders.



When asked what he thought of this station, one soldier said he "liked the variety of missions." His platoon leader might not have shared that sentiment!

STATION 4 — DEMOLITIONS. Both inert and live demolition problems were assigned in a scenario which required the platoon to deny enemy access to a road net. Camouflage and reconnaissance were also graded. The first major task was to calculate and place inert demolitions for a 100 meter abatis. This allowed for maximum utilization of personnel. Several minor tasks were also assigned, including ones employing inert shaped charges and cratering changes. A fuel tanker also had to be rigged for destruction. The final mission called for the platoon to use live explosives to destroy a timber trestle bridge.

The demonstrated proficiency in demolition techniques was uniformly good, but all platoons showed their lack of practice with live explosives by a much slower work rate than with the inert material.

STATION 5 — TACTICS. For most of the platoons, this was a form of **adventure training**, as it marked the first time many of the soldiers had flown in a helicopter. The stated objective of this station was to **determine if the platoons are**



combat ready. It also gave the Battalion's Aviation Section some very beneficial training. In spite of some unseasonably cold evenings, most of the soldiers interviewed agreed that this was one of the most enjoyable stations.

STATION 6 — COMPOSITE. The station was conducted in two distinct phases, with two different objectives. The morning phase tested the platoon's organization and its capability to accomplish multiple tasks. The afternoon phase was designed to evaluate platoon readiness. Overall, the platoon was tested and graded in eleven categories: reconnaissance, work site security, target folders, NBC, adjustment of artillery fire, mine detector operations, vehicle maintenance, communications, vehicle recovery, property accountability and physical fitness.

An undelaying **philosophy**, at all six stations, was to permit the problem to take its own course as directed by the platoon leader. Flexibility was the key element; none looked for one **school solution**, but rather for feasible, workable solutions.



Three days after completion of the last round, a critique was held during which each station OIC summed up common deficiencies and briefed the Battalion Commander. Company Commanders were given a written critique from each station for each of their platoons.

Each station was scored with an equal value of 100 points. When the six stations were tallied, the total scores were very close, whereas the scores at the individual stations showed a wider variance. In fact, the platoon with the highest overall point total actually scored lowest on one station. These results seemed to confirm the PPT had accomplished its prime objective, namely, identifying areas need additional training.

One Lieutenant, whose platoon scored high, stated, "There were a lot of things we didn't know. Some of my Squad Leaders have never been assigned some of the tasks before". His platoon sergeant agreed and added, "The privates have learned a lot and their leaders should have too. Some of the squad leaders haven't done some of these things in a while and have found that they've forgotten a few things."

One private was less introspective; he simply said, "It's been a lot of fun."

A 1972 EOAC Graduate, Captain Conner is presently serving as the S-2 and Information Officer for the 39th Engineer Battalion, (Combat), Fort Devens, Massachusetts. He has also received his BS in Geology from Boston College.

THE ENGINEER SOLDIERS MANUAL

CPT Robert A. Formo

The Soldiers Manual is a new training manual, being developed by the Engineer School, which provides guidance for the administration and evaluation of training for a given MOS. It also provides a uniform training base for each MOS so that the soldier will receive the same instruction for each skill level, whether the instruction is through institutional (such as Advanced Individual Training) or extension (such as unit/on-the-job) training. The manual contains all the MOS related information a soldier will need to know to perform his duties or will tell the soldier exactly where to look up the information in current Technical or Field Manuals or other related sources.

The Soldiers Manual for Engineer proponent MOSs is very similar to those being developed by other Schools. For example it:

- Belongs to the individual soldier.
- Is written in the second person to give the manual a personal flavor.
- Clearly defines the soldier's responsibilities, MOS duties, and shows the actions he must complete to be eligible for promotion.
- Defines the minimum acceptable standards of performance for each task the soldier is responsible to perform.
- Lists references for each task the soldier must perform.
- Establishes conditions under which the soldier must be able to perform his critical tasks.
- Describes standards the soldier must achieve to pass his/her Skill Qualification Test (SQT).

The Engineer Soldiers Manual will serve a variety of different functions:

- The manual provides an accurate and realistic job and task analysis for each MOS.

- It provides a record of the soldier's performance which can be evaluated by each Commander if the need arises.

- It supersedes the requirement for MOS test study guides, since all the material listed in the study guide will be incorporated into this manual.

As shown above, the Soldiers Manual will have a great impact on training the individual soldier in his MOS, whether that training will be in a formal school, on-the-job training, or by self-study.

The Engineer School is currently working on various formats for Engineer Soldiers Manuals.

One such format can be seen in SM 5-81E (Draft). This is the draft Soldiers Manual for the Illustrator (MOS 81E). In September 1975, this draft was sent, worldwide, to 250 selected Illustrators, asking them for comments.

Another draft manual will be published and distributed very shortly. This manual will contain the tasks in which the Mobile Assault Bridge Operator must perform to successfully operate the MAB.

When published in a final format, Soldiers Manuals will be distributed in accordance with DA Form 12-12, Section III. The first finalized Engineer Soldiers Manual will be on the Combat Engineer Career Management Field and is expected to be distributed in FY 1977.

Captain Robert A. Formo is a Project Officer with the Individual Training Branch, Training Programs Division, Deputy Commandant for Combat and Training Developments, US Army Engineer School, Fort Belvoir, Va. He holds a B.S. degree from the University of Minnesota and is a graduate of the Engineer Officer Advanced Course. He served with the 656th Engineer Bn (TOPO); Facilities Engineer Directorate, Long Binh Depot, Vietnam; and the Engineer Advisory Division, MACV.

A Helping Hands Story



SPEC-4 Daniel Blubaugh, 23, Brinkhaven, Ohio and brother, Ronald (Right), 24 of Danville, Ohio, man a hose during firefighting training on a typical weekend drill of the 569th Engineer Detachment, 16th Engineer Brigade, Shreve, Ohio. The Ohio Army National Guard unit is the only OARNG firefighting unit. It is only onw of a handful in the nation.



Firefighter-guardsmen show their stuff while manning one of the fire trucks of the 5694th Engineer Detachment, 16th Engineer Brigade, Ohio Army National Guard. The action takes place just outside the unit's hometown, Shreve, Ohio.

TRADING BA



SGT Jerry Condo

They have traded bandages for fire buckets. The members of the 5694th Engineer Detachment, 512th Engineer Battalion, 16th Engineer Brigade, Ohio Army National Guard, are now firefighters. The big change came June 1, 1974 when the 686th Medical Co. (ambulance) was reorganized as the 5694th Engineer Detachment. Since that time, the unit, which is located at Shreve, Ohio, has given up 36 ambulance trucks and has been acquiring fire trucks.

For the 2 officers and 58 enlisted men (there are no women) of the 5694th, the change over has meant learning a new trade, complete with fire helmets, hose, and big boots. It's something new — and fairly unique. The National Guard Bureau reports that the 5694th is one of only 5 Army

DAGES FOR FIRE BUCKETS

National Guard firefighting units in the nation. Two of them are located in South Carolina, one in Idaho, and one just formed in Montana.

The unit was at annual training at Ft. Sam Houston, Texas in May 1974 when word was received that a different job was awaiting the troops when they got back. The men were not too happy. Subsequently, however, the mood of the Guardsmen changed as they learned more and more about their new role.

Several of the guardsmen found that firefighting is "more interesting" and found the annual training stimulating.

The 5694th went to Chanute Field, Ill. in two sections in July and August to learn about firefighting from the U.S. Air Force which operates a fire school there. The men were taught how to fight structural fires, aviation fires and chemical fires, among other things.

Brig. Gen. Jean G. Peltier, commander of the 16th Engineer Brigade which has headquarters in Columbus, Ohio, shares the enthusiasm of the 5694th about the annual training and the unit's mission. He stated that a firefighting unit is an ideal type of organization for dynamic training because the work is all "hands on."

Firefighting, while new to the 5694th, was old hat to some to the Guardsmen in the unit. One First Sergeant, for instance, has been a member of the Shreve Volunteer Fire Department for 22 years and the captain, commanding officer of the 5694th, is a 13-year veteran of the Wayne, Ohio Volunteer Fire Department. There are also others in the Shreve-based unit who are affiliated with volunteer fire companies.

The equipment the unit is drawing is top of the line. All told, the unit will receive more than \$177,048 in rolling stock when all is delivered. The 5694th has received two brush fire vehicles, four pumpers, and three water trucks. The size of the equipment poses a problem for the Shreve Guardsmen. The armory has no place to house the fire trucks, and as a result, the Ohio National Guard has had to store them in nearby Wooster, Ohio.

A visit to Shreve and the 5694th during a recent weekend drill found the citizen-soldiers busy learning firefighting — and enjoying it. A few hundred yards below the armory the Guardsmen were drawing water from a small creek using two of their new fire trucks. As the pressure shot up and water sprayed out, Guardsmen manned the hoses and trained the hose on targets in the creek. It was noisy, exciting work. The fire trucks looked much like any vehicle in a typical small-town fire department — except the vehicles were olive drab in color.

The First Sergeant admits his Guardsmen are not yet as good as a volunteer fire department, but adds that they're progressing fast in their training. Despite the fact that the unit has been reorganized only about 18 months, 49 out of the 59 enlisted personnel are MOS qualified.

Reception has been good in the Shreve area for the medic-turned-Guardsmen. The 5694th is 108 percent overstrength, according to 1st SGT Peebles. The unit draws personnel from a wide area in north central Ohio. Because of that, some of the Guardsmen spend overnight Saturday on a drill weekend rather than drive to and from home. It is not unusual for the Shreve-based unit members to see horse-drawn vehicles go past the armory. Shreve is located in the midst of Amish country in Ohio.

The Shreve unit has had a long, colorful history and is no stranger to reorganization. Since organized in 1919 in the Ohio National Guard as Company H, 3d Infantry, the unit has seen several redesignations and reorganizations through the years. Prior to being the 686th Medical Company, the Shreve unit was known as "Battalion Reconnaissance, Mortar Davy Crockett and Anti-Tank Platoons, and Battalion Medical Section, Headquarters Company, 2d Battalion, 145th Infantry."

SGT Jerry Condo is the information NCO for the 16th Engineer Brigade, Ohio Army National Guard. SGT Condo is a City Hall reporter for the Columbus, Ohio Citizen-Journal newspaper in civilian life. He lives in McArthur, Ohio.

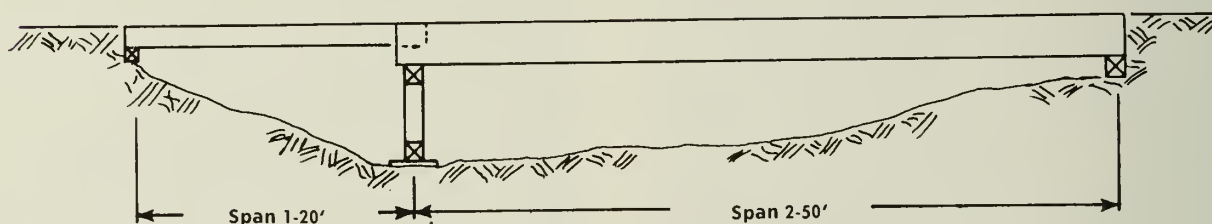
Bridge Classification Wheel

Bridge classification has traditionally been a difficult and time-consuming task. It is also one of the most important tasks undertaken by the military engineer. Yet, little has been done in recent years to simplify or shorten the present cumbersome and complicated classification procedure — that is, until now.

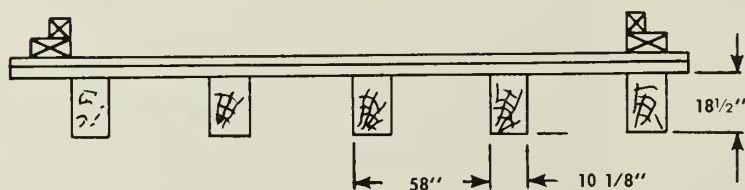
The Fixed Bridges Branch, US Army Engineer School, has recently completed development of a device that should revolutionize bridge classification.

The new device, called the "Hasty Bridge Classification Wheel," is a simple, pocket-sized, easy-to-use, circular calculator which can, in seconds, classify a steel or timber bridge — based on stringer size, spacing, and length. The device is not intended to replace the analytical classification procedures. Instead, it augments them by assisting the soldier in the field when the need for haste overrides the increased accuracy gained by more thorough analytical classification procedures.

Example Problem: Determine the tracked vehicle class of the following bridge.

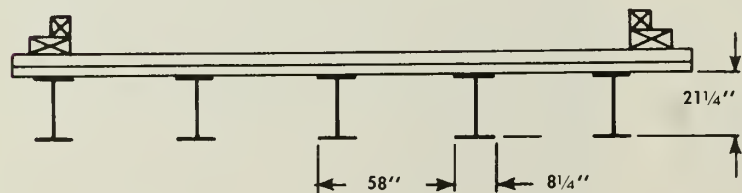


cross section span 1



Stringer size: 10x18
Stringer codes: 5.52
Stringer spacing: 4' - 10"
Class: 27 (lower of 27 & 44)

cross section span 2



Stringer size: 21WF 73
Stringer code: 15.0
Stringer spacing: 4' - 10"
Class: 22

Final Bridge Class: 22

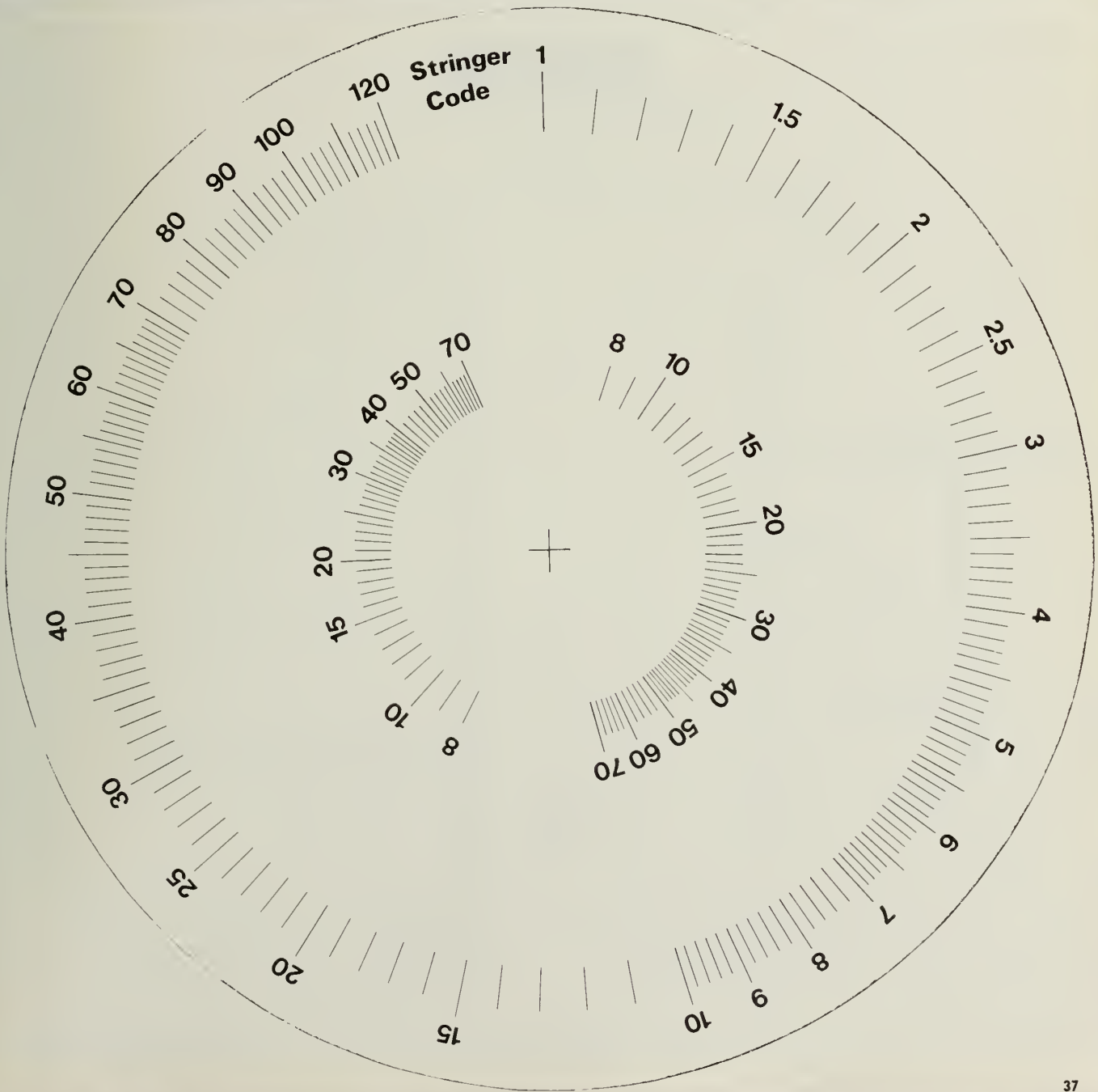
The convenience of the Hasty Bridge Classification Wheel (HBCW) is easily seen when compared to the classification procedures outlined in FM 5-34 (the simplest analytical classification method).

	FM 5-34	HBCW
Number of Steps	17	4
Recon Measurements Required	6	4
Charts Used	4	1
Graphs Used	3	0
Calculations	12	0
Arithmetic Operations	20	0
Time Required (minutes)	30	2

One must keep in mind that the HBCW utilizes certain assumptions which limit its use. The most notable of these are:

- Device can only be used on timber or steel simply supported bridges (or spans).
- Final classification is for one-way traffic.
- Classification is for tracked vehicles only. (It should be noted that from spans of approximately 14-60 ft, tracked vehicle bridge class would be the limiting case. This restriction will be removed in the final version of the device).
- Bridge deck is assumed adequate for all tracked vehicular traffic.

As far as accuracy is concerned, the HBCW is generally accurate to within 5% of the actual bridge class as determined by detailed analytical procedures, in many cases more accurate than the FM 5-34 procedure.



A copy of the HBCW is provided for cutting out and assembling. The Fixed Bridges Branch, US Army Engineer School, is interested in any comments, observations, or suggestions on the device or ways to improve it. The device has been analytically tested and upon completion of its field testing, may eventually be adopted as a bridge classification tool.

A similar device, "Armor Bridge Classification Wheel," was produced at Fort Belvoir for the US Army Armor School and is currently undergoing field testing by the Armor community.

Please address comments to:

Fixed Bridge Branch, D/ES
US Army Engineer School
Fort Belvoir, VA 22060

The classification wheel was developed as a joint effort by personnel from Fixed Bridges Branch, Engineer Design Division, Dept of Engi-

neering Science, USAES, Ft. Belvoir. It is currently undergoing tests and is expected to be in the field within the next three months.

IMPORTANT

IF ANY PART OF THE BRIDGE IS DAMAGED OR EXCESSIVELY WORN, DO NOT ATTEMPT TO USE THIS CARD. CALL YOUR LOCAL ENGINEER UNIT.

INSTRUCTIONS FOR USE

1. Obtain the following information for each span of the bridge:

- Stringer Dimensions. Measure b & d to the nearest inch for timber and 1/8 inch for steel.
- Stringer Spacing. Measure center to center to the nearest inch.
- Span Length. Measure from center of support to center of support to nearest 1/2 ft.

NOTE: If deck is less than 6 inches thick, ensure vehicle tread rides over stringer.

2. Identify the bridge stringers from the following charts and determine proper stringer code.

Timber		
b x d	Codes	
6x12	12,0	1,47
6x14	14,0	2,00
6x16	16,0	2,62
6x18	18,0	3,31
8x12	16,0	1,96
8x14	18,7	2,67
8x16	21,3	3,49
8x18	24,0	4,42
8x20	26,7	5,45
8x22	29,3	6,60
8x24	32,0	7,85
10x10	16,7	1,70
10x12	20,0	2,45
10x14	23,3	3,34
10x16	26,7	4,36
10x18	30,0	5,52
10x20	33,3	6,81
10x22	36,7	8,25
10x24	40,0	9,81
12x12	24,0	2,94
12x14	28,0	4,01
12x16	32,0	5,23
12x18	36,0	6,62
12x20	40,0	8,18
12x22	44,0	9,90

Steel	d	b	Code
39WF211	39"	11"	78,7
37WF206	37"	11"	73,6
36WF300	36"	16"	110,5
36WF194	36"	12"	66,3
36WF182	36"	12"	62,1
36WF170	36"	12"	57,9
36WF160	36"	12"	54,1
36WF230	35"	16"	83,5
36WF150	35"	12"	50,3
36WF201	35"	11"	68,7
33WF196	33"	11"	63,7
33WF220	33"	15"	73,8
33WF141	33"	11"	44,7
33WF130	33"	11"	40,5
33WF200	33"	15"	66,9
31WF180	31"	11"	59,0
30WF124	30"	10"	35,4
30WF116	30"	10"	32,8
30WF108	29"	10"	29,9
30WF175	29"	11"	51,4
27WF171	27"	11"	47,1
27WF102	27"	10"	26,6
27WF94	26"	10"	24,3
26WF157	25"	11"	40,7
24WF94	24"	9"	22,1
24WF84	24"	9"	19,6
24WF100	24"	12"	24,9
241120	24"	8"	25,1
241106	24"	7"	23,4
24180	24"	7"	17,4
24WF76	23"	9"	17,5
24WF153	23"	11"	36,8
241134	23"	8"	28,2
22175	22"	7"	13,7
21WF139	21"	11"	31,1
211112	21"	7"	22,0
21WF73	21"	8"	15,0
21WF68	21"	8"	14,0
21WF62	21"	8"	12,6
20185	20"	7"	15,0
20165	20"	6"	10,9
20WF134	19"	11"	27,6
18WF60	18"	7"	10,8
18186	18"	7"	14,5
18WF55	18"	7"	9,78
18180	18"	8"	13,0
18WF50	18"	7"	8,89
18155	18"	6"	8,84
18WF122	17"	11"	28,8



×



Steel	d	b	Code
18162	17"	6"	10,6
18177	17"	6"	12,5
16WF112	16"	11"	20,0
16170	16"	6"	10,6
16WF50	16"	7"	8,04
16WF45	16"	7"	7,24
16WF64	16"	8"	10,4
16WF40	16"	7"	6,44
16150	16"	6"	6,89
16WF36	15"	7"	5,64
16WF110	15"	11"	15,3
16162	15"	6"	8,89
16145	15"	5"	6,67
15WF103	15"	11"	16,4
15156	15"	5"	7,69
15143	15"	5"	5,87
14WF101	14"	11"	15,3
14140	14"	5"	5,29
14151	14"	5"	6,67
14170	14"	8"	9,07
14157	14"	6"	6,80
14140	14"	5"	5,38
14WF34	14"	6"	4,84
14WF30	13"	6"	4,18
14WF92	13"	11"	13,2
14146	13"	5"	3,78
13135	13"	5"	3,60
13141	12"	5"	4,80
12WF36	12"	6"	4,58
12165	12"	8"	8,09
12WF27	12"	6"	3,38
12150	12"	5"	5,02
12132	12"	5"	3,60
12134	11"	4"	3,60
11WF76	11"	11"	2,38
10129	10"	4"	8,98
10WF25	10"	5"	2,62
10140	10"	6"	4,09
10135	10"	5"	2,89
10125	10"	4"	2,44
10WF21	9"	5"	2,13
10WF59	9"	9"	5,87
9125	9"	4"	2,27
9150	9"	7"	4,58
8135	8"	6"	2,89
8128	8"	5"	2,18
8WF31	8"	8"	2,71
8WF44	7"	7"	3,60
7WF35	7"	7"	2,58
6WF31	6"	6"	2,00

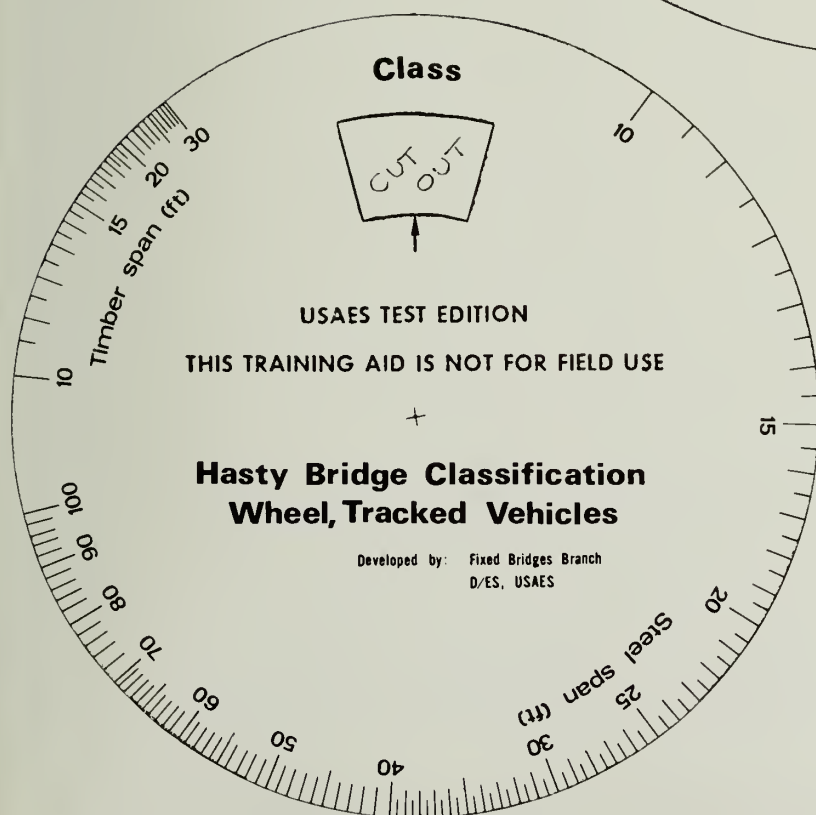
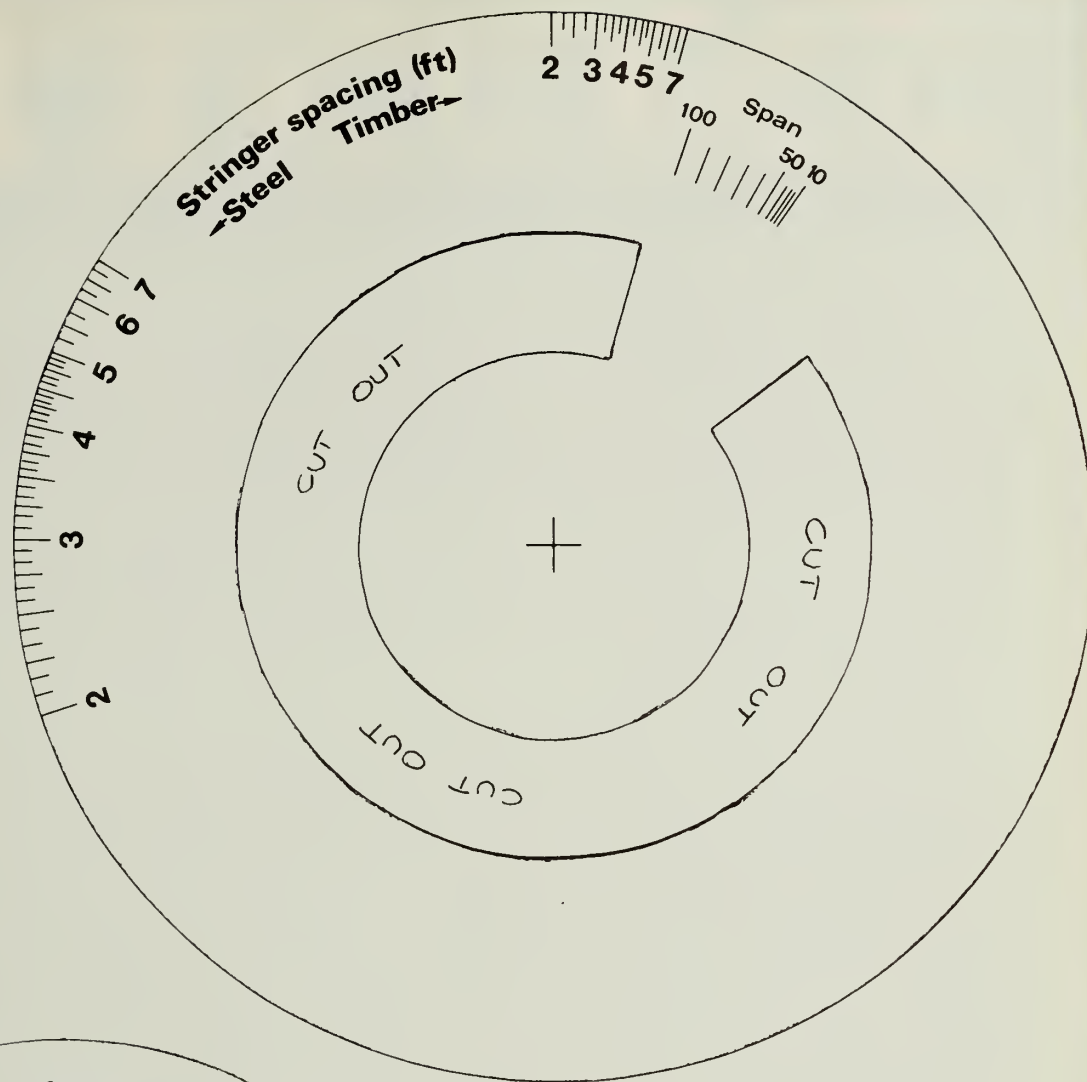
Timber		
b x d	Codes	
12x24	48,0	11,8
14x14	32,7	4,67
14x16	37,3	6,11
14x18	42,0	7,73
14x20	46,7	9,54
14x22	51,3	11,5
14x24	56,0	13,7
16x16	42,7	6,98
16x18	48,0	8,83
16x20	53,3	10,9
16x22	58,7	13,2
16x24	64,0	15,7
18x18	54,0	9,94
18x20	59,0	12,3
18x22	64,0	14,8
18x24	69,0	17,7
128	21,2	1,74
138	25,0	2,20
148	29,0	2,75
168	37,7	4,11
188	47,7	5,86
208	59,0	8,03
228	69,5	10,7
248	79,9	13,8

3. Steel Stringer Classification Procedure.

- Locate bridge stringer code on outer wheel.
- Rotate middle wheel until the steel stringer spacing is aligned with it.
- Rotate the inner wheel until the steel span length of the bridge is aligned with the span on the middle wheel.
- Determine bridge class from window.

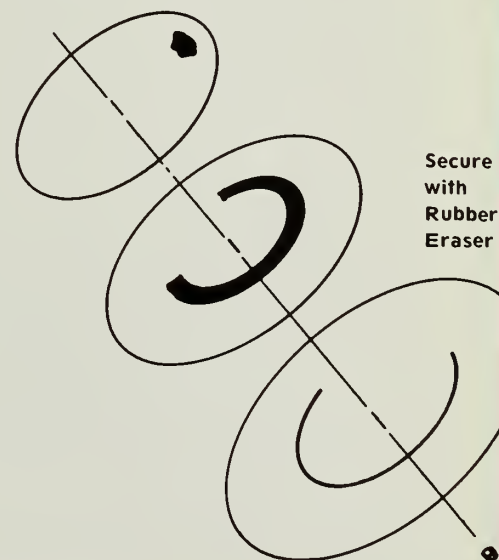
4. Timber stringer classification procedure.

- Classify the bridge in accordance with the procedure outlined in para 3. Use the first stringer code, timber stringer spacing, and timber span length.
- Reclassify, using the second stringer code as if it were steel (use steel stringer spacing and steel span length).
- The lower of the above classes is the final bridge class.



Cut out and assemble as shown below

Thumb Tack



Secure with Rubber Eraser

Center point must match up exactly with center point on large wheel.

ENGINEER

Current Status — Foreign Area Officer Specialty

In November 1974, the Foreign Area Officer (FAO) Specialty Program came to an end and FAO became one of the Officer Personnel Management System (OPMS) advanced entry specialties. As has been the case in all specialties, much analysis and study has been, and continues to be made to more precisely define position, personnel, and training requirements. The following relevant statistics will serve as a base for further discussions.

	GRADE				
	COL	LTC	MAJ	CPT	TOTAL
Total FAO Positions	204	344	261	262	1,071
Total Army FAO Officers	35	677	945	655	2,312
Total EN FAO Officers	1	66	71	60	198

A rapid comparison of positions and officers reveals a major shortage problem at the rank of Colonel while other ranks are adequately filled with personnel. Shortage of FAO qualified colonels is being alleviated to some extent by "out of specialty" assignments and grade substitutions. An additional problem, not obvious from statistics, stems from the fact that many of the officers identified above are designated as Foreign Area specialists, but are not yet trained assets. This presents a major professional development challenge. The bright spot in the overall picture is the fact that we now have FAO requirements well defined and personnel have been identified for training and repetitive utilization. Intensive management is particularly essential in FAO because of the heavy colonel requirements. While it would be ideal to designate sufficient officers in each grade to insure a steady flow to the grade of colonel and maintain a 50% utilization rate (ie: 2 officers for each position), this solution would create undue stress elsewhere in the system. While it is fully realized that the training required for FAO is more time consuming and extensive than for most other specialties and while every effort will be made to develop the most capable and qualified officers, it must be clearly stated that the FAO specialty designation is not an automatic ticket to lengthy schooling and training. The perception that the training package which included the FAO Course at the Institute of Military Assistance, Graduate School, language training, and in-country training, that was associated with the Foreign Area Officer Special Career Program is to be provided to all officers designated in this specialty is incorrect. It must be understood that 20% of the FAO positions are "area unspecified" positions which reduces the training requirement for officers filling these positions. Also, the requirement that an officer's overall manner of performance be in the upper $\frac{1}{3}$ in comparison with his contemporaries applies to all graduate studies, including FAO related schooling. Additionally, maximum utilization will be made of previously trained assets so as to avoid unnecessary retraining or duplicative type assignments. The timing or sequencing of FAO related training raises many questions. Basically, FAO officers should begin training as soon after designation as is possible and in some cases selected officers may begin training prior to the designation process. Delays in formal training will most commonly be related to the non-availability of the officer (i.e. committed to other assignments), requirements for further experience and development in the primary specialty or a low manner of performance which would make costly training and unrated time prior to O4 promotion unwise both from the standpoint of the Army and the individual. As to the sequence of training, almost any order is acceptable as long as language training is closely followed by a utilization opportunity. The training of each FAO officer will be carefully planned and coordinated between the appropriate OPD Division and the individual officer. Each officer is enjoined to improve his qualifications through self-study whenever the opportunity presents itself.

Officers who have yet to reach the alternate specialty designation point, but who are interested in the FAO specialty can enhance their chances by insuring that all FAO related qualifications are

POTPOURRI

made known to their career division and also that they have a Defense Language Aptitude Test (DLAT) score recorded on their Officer Record Brief (ORB).

This specialty combines effectively with almost any other specialty and offers an excellent career in peacetime as well as wartime. A wide variety of assignments ranging from military assistance and advisory duties to psychological operations assignments to strategic intelligence and attache functions are available in this field. The repetitive use of trained personnel in these assignments will create better qualified personnel and enhance cost effective operations. While the statistics shown above do not reflect an exceptionally large number of Engineer officers participating in FAO, the specialty combination of Engineer (21) and FAO (48) is deemed very acceptable and any interested officer should carefully consider the opportunities and challenges presented by such a combination.

Project Manager Development Program (PMDP)

The PMDP was established for the professional development of officers pursuing a career in managing the acquisition of major defense systems. Unlike an OPMS specialty, which is a distinct grouping of similar positions in which officers receive professional development, the PMDP encompasses a variety of positions in a number of specialties. Chapter 30, DA Pamphlet 600-3, currently under revision, prescribes the policies and procedures for the identification and management of officers in the PMDP.

The purpose of the PMDP is to identify and develop qualified commissioned officers to support future requirements for project managers and other senior officers within materiel acquisition activities in the Department of Defense. The PMDP is applicable to all commissioned officers serving in the grade of captain through colonel on active duty except officers of the Judge Advocate General's Corps, Chaplains and the Army Medical Department. Potential project managers will receive development in materiel acquisition related functions, namely, Research and Development, Procurement, and General Logistics; development in skills related to a particular type of materiel, such as missiles, armaments, or munitions; and development in basic management skills, such as program planning and control, needed by all project managers. This concept of professional development is referred to as interspecialty development. For most officers in the PMDP, the application of this concept will entail them spending most of the remainder of their career in program related duties. In practice, interspecialty development builds on an officer's qualifications in his primary and alternate specialties and provides the opportunity for the potential project manager to round out his background through assignments to developmental positions and appropriate schooling.

The eligibility criteria for participating in the PMDP are:

- Completed six years Active Federal Service.
- Posses specialty related to project manager functions (i.e., Research and Development, Procurement, a technically oriented specialty such as C-E Engineering, one of the materiel management specialties, Comptroller, ADP or ORSA) or have project manager related experience.
- Have a military education appropriate to grade and length of service.
- For civil schooling have a Bachelor's degree with discipline in Business, Engineering, Physical Science, or have any Bachelor's degree if officer has project manager related experience.
- By manner of performance have demonstrated high level of intelligence, initiative, imagination, judgement and potential for project manager development (to grade of colonel).
- Indicate desire to participate.

ENGINEER

- Have six years Active Federal Service remaining.

An officer who meets the above criteria may apply for participating in the program by submitting a letter of application. The applicant's immediate military superior will indorse the application and forward it directly to HQDA (DAPC-OPF-D), 200 Stovall Street, Alexandria, Virginia 22332. The current status of the PMDP and the participation of Engineer officers in the program is indicated below:

	GRADE				
	COL	LTC	MAJ	CPT	TOTAL
Desired Strength	202	342	459	280	1,283
Current Army Wide Strength	2	160	159	41	362
Current EN Br Participating	0	8	17	4	29

Many Engineer officers possess the unique skills outlined in the eligibility criteria and may well consider this program as they plan career objectives. The importance of this program to the efficient operation of the Army cannot be over emphasized. All officers with experience, training or interest in participating in this growing effort are urged to submit an application for consideration.

Contracting Officer

If you have served in an assignment within the OCE family and have been awarded the "Contracting Officer Certificate" (DD Form 1539), we have made provisions for this to be reflected in the data printed on the Officer Record Brief. Knowledge of this qualification will materially assist the assignment desk officer in assignment management and will provide an identification of officers required in crisis situations. If you possess this certification, send your assignment officer a copy.

Assignments

With personnel management fully under OPMS, the assignment of officers within the primary/alternate specialty framework requires several actions by each officer to insure we and you are able to effectively develop you professionally, meet your preferences, and, above all, support the mission of the Army. Officers who have already received alternate specialty designation (or who have not yet been designated) and desire to be considered for an assignment within that field should make your desires known a minimum of twelve months prior to your date of availability for reassignment. Officers eligible for overseas assignments will be screened nine months prior to reassignments and officers returning from overseas or moving within CONUS will be considered approximately six months prior to availability date. With requirements to program so far in advance it is most important for those going on an unaccompanied overseas tour or to short duration courses (e.g. EOAC) that you pay considerable attention to the succeeding assignments. Of course, one way to insure that your preferences are always documented is to maintain an up-to-date preference statement is your Career Management Individual File.

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Current Locations of Active Engineer Battalions

Considerable changes have occurred in Engineer Battalion designation and location — here is an update.

CONUS

NOTE:

- * Re-designated as "Combat (Heavy)"
- Units activated during FY 76

- 1st Engineer Battalion, 1st Inf Div
- 3rd Engineer Battalion, 24th Inf Div
- 4th Engineer Battalion, 4th Inf Div (M)
- 5th Engineer Battalion (Combat)
- 7th Engineer Battalion, 5th Inf Div (M)
- 8th Engineer Battalion, 1st Cav Div
- 11th Engineer Battalion (Combat)
- 13th Engineer Battalion, 7th Inf Div
- 14th Engineer Battalion (Combat)
- 15th Engineer Battalion, 9th Inf Div
- 17th Engineer Battalion, 2nd Armd Div
- 19th Engineer Battalion (Combat)
- 20th Engineer Battalion (Combat)
- 27th Engineer Battalion (Combat) (Abn)
- 30th Engineer Battalion (Base) (Topo)
- 34th Engineer Battalion (Construction)*
- 39th Engineer Battalion (Combat)
- 43rd Engineer Battalion (Construction)*
- 46th Engineer Battalion (Construction)*
- 52nd Engineer Battalion (Construction)*
- 62nd Engineer Battalion (Construction)*
- 76th Engineer Battalion (Construction)*
- 92nd Engineer Battalion (Construction)*
- 299th Engineer Battalion (Combat)
- 307th Engineer Battalion, 82nd Abn Div
- 326th Engineer Battalion, 101st Abn Div
- 548th Engineer Battalion (Construction)*
- 588th Engineer Battalion (Combat)
- 864th Engineer Battalion (Construction)*

Fort Riley, Kansas
 Fort Stewart, Georgia
 Fort Carson, Colorado
 Fort Leonard Wood, MO
 Fort Pol, Louisiana
 Fort Hood, Texas
 Fort Belvoir, Virginia
 Fort Ord, California
 Fort Ord, California
 Fort Lewis, Washington
 Fort Hood, Texas
 Fort Know, Kentucky
 Fort Campbell, Kentucky
 Fort Bragg, North Carolina
 Fort Belvoir, Virginia
 Fort Riley, Kansas
 Fort Devens, Massachusetts
 Fort Benning, Georgia
 Fort Rucker, Alabama
 Fort Carson, Colorado
 Fort Hood, Texas
 Fort Meade, Maryland
 Fort Stewart, Georgia
 Fort Sill, Oklahoma
 Fort Bragg, North Carolina
 Fort Campbell, Kentucky
 Fort Bragg, North Carolina
 Fort Gordon, Georgia
 Fort Lewis, Washington

EUROPE (GERMANY)

NOTE:

- * Re-designated as "Combat (Heavy)"

- 9th Engineer Battalion (Combat)
- 10th Engineer Battalion, 3rd Inf Div
- 12th Engineer Battalion, 8th Inf Div
- 16th Engineer Battalion, 1st Armd Div
- 23rd Engineer Battalion, 3rd Armd Div
- 54th Engineer Battalion (Combat)
- 78th Engineer Battalion (Combat)
- 79th Engineer Battalion (Construction)*
- 82nd Engineer Battalion (Combat)
- 94th Engineer Battalion (Construction)*

- 237th Engineer Battalion (Combat)
- 249th Engineer Battalion (Construction)*
- 293rd Engineer Battalion (Construction)*
- 317th Engineer Battalion (Combat)
- 547th Engineer Battalion (Combat)
- 549th Engineer Battalion (Service)
- 559th Engineer Battalion (Service)
- 563rd Engineer Battalion (Service)
- 565th Engineer Battalion (Service)
- 649th Engineer Battalion (Topo)

HAWAII

- 65th Engineer Battalion, 25th Inf Div
- 84th Engineer Battalion (Construction)*
- 652nd Engineer Battalion (Topo)

Schofield Barracks, Hawaii
 Schofield Barracks, Hawaii
 Ford Island, Hawaii

KOREA

NOTE:

- * Re-designated as "Combat (Heavy)"

- 2nd Engineer Battalion, 2nd Inf Div
- 44th Engineer Battalion (Construction)*
- 802nd Engineer Battalion (Construction)*

Camp Casey, Korea
 Camp Mercer, Korea
 Camp Humphreys, Korea

BRIDGING

AVIATION TO BECOME OPMS SPECIALTY

As a result of recommendations made in a detailed ODCSPER study of the Army's aviation management system, the addition of Aviation to the list of specialties under OPMS has been approved.

Originally, Aviation had not been designated as a separately managed specialty because of the relatively low number of aviator positions at the LTC and COL level and because aviation skills were identified as integral to 35 of the 47 approved OPMS specialties. However, the Aviation Career Incentive Act of 1974 and projected aviator strength imbalances severely impacted on the planning for aviator professional development under the "aviation as skill" concept; the demands of the legislation to gain optimum return on aviator training investments restricted many aviator management options under consideration at the time.

The new Aviation specialty concept — scheduled for implementation in early 1976 — will be keyed to meeting field grade aviator requirements. The main features of the concept include the following:

- Aviation will become an advanced entry specialty designated in an officer's eighth year of service.
- Aviators will be trained and assigned based upon their basic entry specialty.
- In the future, only officers from Infantry, Armor, Field Artillery, Air Defense Artillery, Engineer, Signal Corps, Transportation Corps, and Military Intelligence branches may receive flight training.
- Officers will enter flight school between their 24th and 60th months of commissioned service, except for those in the Aviation Materiel Management specialty who will attend upon completion of the Transportation Officer Basic Course.

NEW INVOLUNTARY RETRAINING/RECLASSIFICATION PROGRAM

Armywide overages of noncommissioned officers in a number of Combat Support and Combat Service Support MOSs and critical shortages in the Combat Arms field have led to a new program for retraining and reclassifying career soldiers into Combat Arms MOSs. The program is intended to satisfy two major needs of the Army: to balance the enlisted MOS/grade structure, and to increase Combat Arms strengths to fill the requirements of a 16-Division Force.

To meet these goals, MILPERCEN's Enlisted Personnel Directorate (EPD) is screening the records of enlisted soldiers in MOSs that are overstrength Armywide. Physical profiles, Enlisted Evaluation Scores, status of enlistment or reenlistment bonuses (i.e., not receiving EBs, VRBs, SRBs), and the soldier's potential to qualify and compete in another MOS are some of the factors EPD will consider before selecting a soldier for involuntary reclassification from an overstrength skill into the Combat Arms field.

Upon selection, the soldier will be retrained formally and reclassified into an appropriate Infantry, Armor, Combat Engineer, Field Artillery, or Air Defense Artillery PMOS. His former skill will then be designated as his SMOS, and he will be required to maintain proficiency in the new PMOS.

Initial classes of approximately 30 soldiers each will begin retraining for MOSs 82C (Artillery Surveyor) and 13E (Field Artillery Cannon Operations) at Ft. Sill, OK, and MOS 13B (Field Artillery Crewman) at Ft. Hood, TX, in January 1976. After completing the courses, soldiers will remain on station for at least one year to gain additional skills, knowledge and experience in their new MOSs.

All soldiers involuntarily reclassified into the Combat Arms field will be notified by personal letters which explain the program and stress that selection is neither based on substandard

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performance nor punitive action. A special letter will be included in each soldier's Official Military Personnel File (and 201 "Field" File for E-5s) to indicate to future Promotion Selection Boards that the involuntary reclassification action should not be viewed as adverse, and that without exception, only those soldiers who have records of satisfactory performance are being selected for the program.

All involuntary reclassifications into Combat Arms MOSs are dictated by the needs of the Army. MILPERCEN will reconsider only those soldiers who for cogent military reasons (i.e., physical disqualification) forward within 14 days of receipt of notification the required documents supporting requests for deletion from the program.

EMERGENCY LEAVE POLICY REVISED

New guidance expanding current policies under which emergency leave and administrative absence may be authorized was recently incorporated into AR 630-5 and implemented by a MILPERCEN message.

Effective 17 November 1975, conditions under which service members may take emergency leave have been broadened to include emergency situations involving an immediate family member of the service member's spouse. Prior to this change, soldiers were only authorized emergency leave in connection with an emergency involving the service member's immediate family. Immediate family members include parents, brothers, sisters, children, persons in loco parentis, or the sole surviving blood relative.

A new paragraph (6-10d) has also been added to the "Leave, Passes, Administrative Absence, and Public Holidays" regulation allowing dependents of service members to travel "space-available" on DOD owned or operated aircraft in conjunction with a bona fide family emergency in accordance with DOD Regulation 4515.13-R provided they possess written authorization.

A final change to the emergency leave section (Chapter 6) of the regulation involves military personnel assigned to the Military Assistance Program (MAP) who are stationed in areas not serviced by scheduled Military Airlift Command (MAC) flights. In the future, soldiers travelling on emergency leave will only be authorized transportation on DOD owned or operated aircraft to an from a location where MAC transportation can be acquired. In the past, commercial transportation to a MAC-serviced area was also authorized at government expense.

Conditions under which an administrative absence may be taken have also been broadened in the regulation. In addition to meetings sponsored by recognized professional legal/ecclesiastical societies and organizations, an administrative absence may be taken for attendance at meetings sponsored by recognized non-federal technical, scientific, and professional medical organizations. In order to qualify, the meetings must be of a nature which does not require the approval of the Secretary of the Army and must bear a direct relationship to the service member's professional background or primary duties while clearly enhancing the individual's value to the Army.

Further details of the policy changes to AR 630-5 are contained in the implementing MILPERCEN message 171720Z November 1975.

SPECIAL FORCES VACANCIES

Positions are currently open in Special Forces units for volunteers in MOSs O5B (Radio Operator), 12B (Combat Engineer), and 91B (Medical Specialist).

Selected soldiers in these MOSs will be Airborne and Special Forces trained before they report to their Special Forces units in Panama, Germany, Korea, Thailand, or Forts Bragg, NC, or Devens, MA.

Soldiers interested in a Special Forces assignment should submit a volunteer request in accordance with Chapter 12 of AR 614-200 through channels to the Commander; US Army Military Personnel Center; ATTN: DAPC-EPK-S; 2461 Eisenhower Avenue; Alexandria, VA 22331.

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FOR PEOPLE WHO
LIKE TO DRAW..**

....OR WRITE...

OR TAKE PICTURES

IF YOU ARE ONE

OF THESE PEOPLE

HELP US OUT

WHY NOT SEND

AN ARTICLE OF

GENERAL INTEREST

TO: EDITOR

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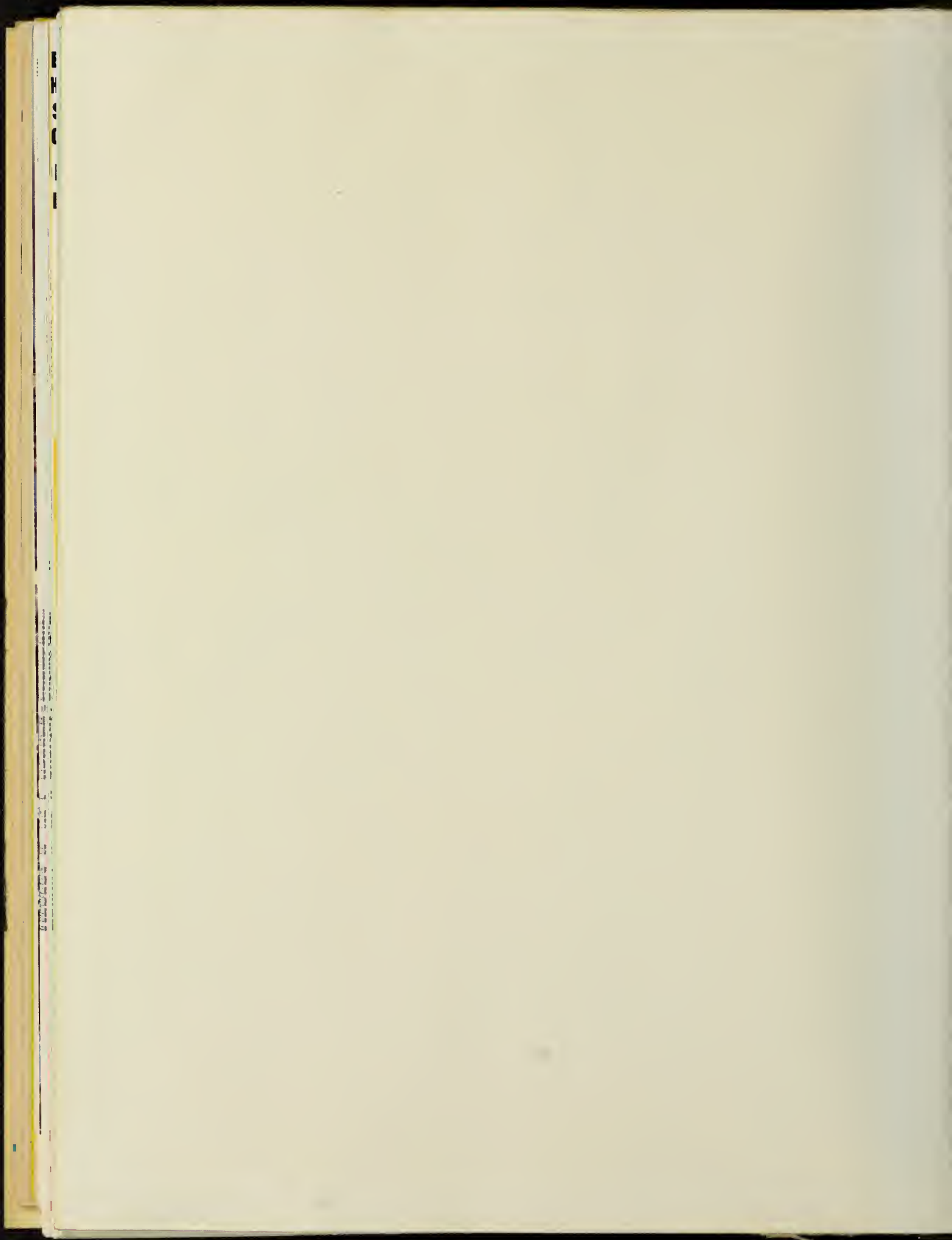
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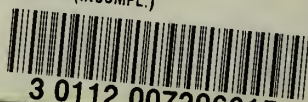








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